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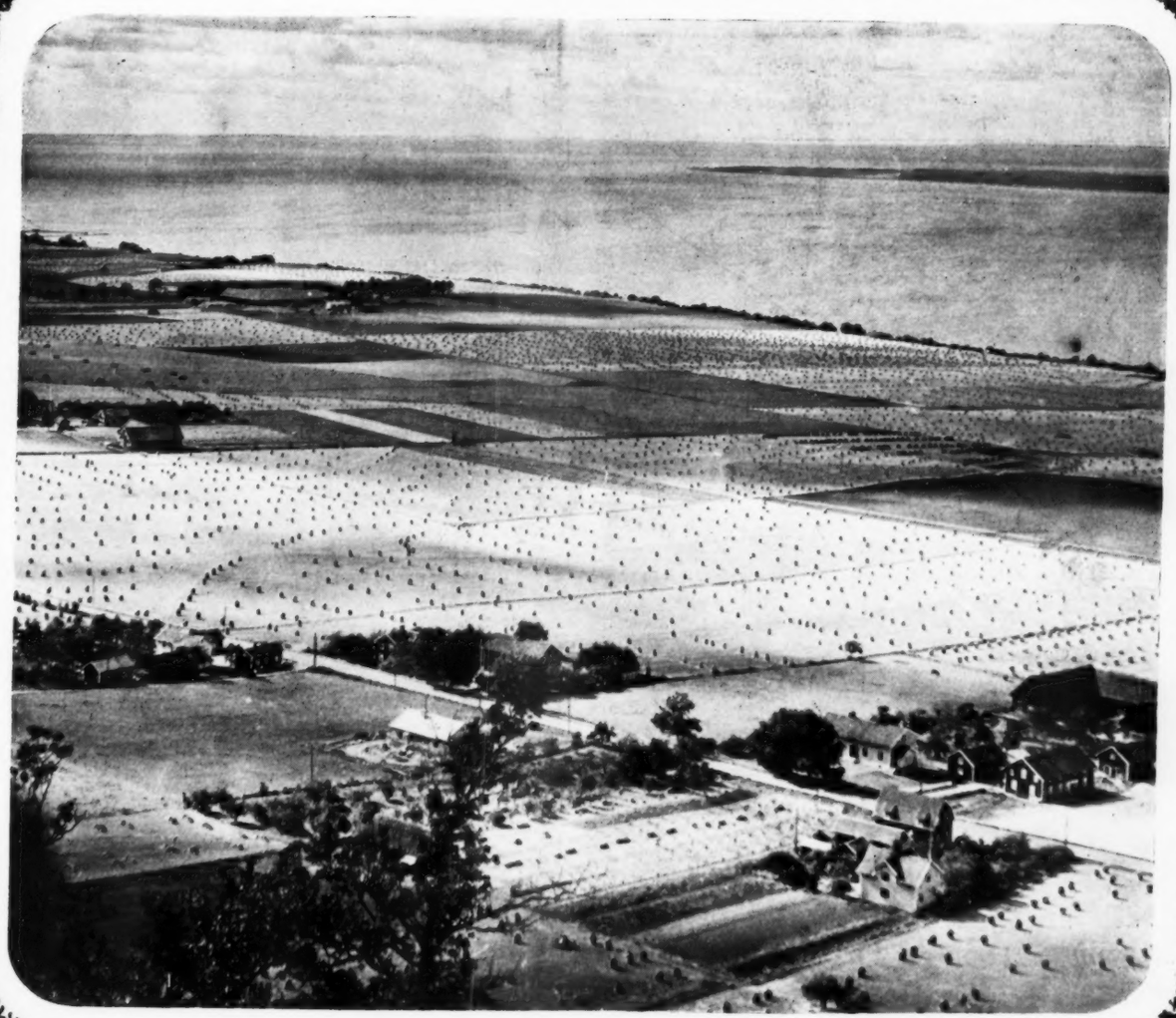

VOLUME 4, No. 9 SEPTEMBER 1952

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WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.

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Editorial Comment

Zamindari in India

JULY 1 was a notable day in the history of India, since on that day in the Uttar Pradesh, formerly the United Province, the Governor under the powers conferred on him by the recent U.P. Act entitled the Zamindari and Land Reform Act, vested in the State all the land formerly belonging to the two million Zamindar landowners.

The event was made an occasion for general rejoicing throughout the State and was observed as a public holiday. Public meetings were held in many parts, and among those who addressed the peasants were the Indian Prime Minister, Pandit Jawaharial Nehru, and the U.P. Chief Minister, Pandit B. G. Pant.

Largely created under British rule in India as the result of insufficient comprehension of the previously existing position, the Zamindar landlord system has long been a source of dissension and difficulty in India. Its abolition has been advocated by many authorities, but the difficulties were many. A book which gives an account, admittedly *ex parte*, of the system is *Problems of Zamindari*, by Professor F. N. Driver, published in Bombay in 1949 and reviewed in this journal last year (WORLD CROPS, **2**, 149).

Although the abolition of the Zamindars is the first step, it is but the first in a series of land reforms and it is for the future to show what form of tenure will be devised to take its place and whether it will be found possible to evolve a system which will satisfy popular desires and aspirations and at the same time render possible the many reforms and readjustments in Indian land usage for which there is such abundant need. In his speech on this occasion Pandit Nehru strongly emphasised that the act of abolition was only the first step towards the goal they had in view; many others would be necessary before the land problem could be regarded as settled.

Doubtless the action now taken in Uttar Pradesh will find its counterpart in due course in other parts of India. Let us hope that it may in reality prove the prelude to great and beneficial changes in Indian agriculture.

Shortage of scientists

BOTH the 1952 Report of the Advisory Council on Scientific Policy and the debate on science and industry that followed in the House of Lords made it grimly clear that Britain faces a shortage of trained scientists in the years ahead. Shortages of vital needs are characteristic of our time, but this particular gap between supply and demand may prove to be the most serious of all. Nor should it be looked upon as a problem that faces industry alone. Agriculture, indeed, is doubly affected inasmuch as scientists are needed for direct advisory work and research as well as for the production of machinery, fertilisers, insecticides, etc., in the ancillary industries. Nor are Britain's home needs the only consideration. It is essential, if world food production is to expand, for Britain to increase the scientific help she can offer to less developed countries, particularly to her own colonies and younger dominions. There, in fact, the application of modern scientific methods can lead to the biggest increases in yield.

It was recently announced by Lord Woolton that the Government intends to investigate urgently the possibility of creating a new technological institution with university status, and there seems little doubt that these intentions will be given high priority. Equally, there is little doubt that industry and not farming will benefit most directly from this development, and the question must be asked whether our arrangements for training agricultural scientists should not also be widened. In agricultural research the pure scientist, uninhibited by preconceived ideas about farming, has often made notable contributions to the solution of agricultural problems. For advisory work, however—and it is for this we need the greatest flow of recruits—a technological training is indispensable. Is the output of new men sufficient to balance wastage and expand the British contribution both at home and abroad? There are certainly critics of scientific advisers in farming but their views may spring from their own inability to accept sound guidance or may, with less prejudice, be based upon unfortunate experiences. The effectiveness of advice depends upon the personality and ability of the adviser and no one who has seen a really good adviser—knowledgeable and able to explain his suggestions clearly—in action can doubt that his work increases the productivity of acres. But such men require as much specialised training for their jobs as do the technologists required in industry. It is not enough to hope that a sufficient number of men with agricultural science degrees will make good advisers; for if as a whole scientists are in short supply, a greater proportion of young men from the universities will be attracted into industry rather than to agriculture as the result of supplying fuller facilities for higher training. In this, as in other aspects of competition for resources, agriculture cannot afford to be a Cinderella.

Crops and canning

TWO recent surveys of British food canning developments—a paper read by Mr. J. Ryan to the Royal Statistical Society and an article on fruit for canning by Mr. F. Hirst of the Chipping Campden Research Station (*Worcs. Agric. Chronicle*, 1952, **20**, 3)—have emphasised the great importance of this method of crop preservation and distribution. For the grower and consumer alike, canning brings profit; to minimise losses from bacterial decay at times of seasonal crop surplus increases the food producer's market and adds to the public's diet. In Britain from 1924 to 1951 the tonnage of canned fruit produced has risen from 5,600 tons to 74,300 tons; for canned vegetables the increase is even more striking—from 1,000 to 298,000 tons. Even so, these figures do not represent the full potentialities of canning; expansion of the British

industry since the war has been severely limited by the shortage of tinplate. In the fruit-growing areas of England there is still a disturbing wastage of fruit each season because the local canning factories are obliged to fix their purchases according to their tinplate allocations.

Before the war Britain imported canned peaches, apricots, pears, and pineapple on a large scale. The home industry could compete only with soft fruits. This background decided the pattern of the fruit canning industry for, as soft fruits do not travel well, the factories were mainly set up in the soft fruit-growing areas. With imports of canned fruit severely reduced since the war, the opportunity for the home grown and home canned soft fruits has been enormous, virtually unlimited. However, tinplate has fixed the level of expansion. Had this not been so, it is doubtful whether soft fruit production would have always been sufficient to meet the demands of the canning factories. The acreage under soft fruits in Britain declined seriously during the war. For canning, certain varieties are much better than others; picking, too, must take place at precise stages in ripening. Could the post-war rehabilitation of Britain's soft fruit industry have produced in a few years the total tonnage that unlimited canning factories would have been prepared to buy? This must be doubted. To some extent the same doubts would apply were the tinplate shortage to vanish in 1953. The British soft fruit industry would seem to require the services of a foolproof soothsayer for the supply position of tinplate could easily change much more swiftly than the cropping policy of a fruit farm can be altered. However, any sudden change in world economic conditions that significantly eased the tinplate situation would similarly ease Britain's ability to purchase imported goods. Canned pineapple and apricots from abroad would again compete on the grocers' shelves. The quality of home-produced canned gooseberries or raspberries would have to be first-class to meet this challenge.

Approved crop protection products

THE British Ministry of Agriculture has recently issued a new list of officially approved crop protection products.

It will be remembered that this scheme was inaugurated in 1942 with the object of giving guidance to the grower in the choice of materials for the protection of his crops. It is a voluntary scheme and for a product to be admitted thereto it must have received approval of the Ministry of Agriculture as complying with their standards of composition and performance. The approval relates, of course, only to conditions in Great Britain and to a limited period after manufacture. Approved products bear an official mark as well as a group letter identifying the type of product and a reference number which identifies the manufacturer.

Originally conceived to include only insecticides and fungicides it was later extended to cover also herbicides.

During its ten years' existence the scheme is admitted almost universally to be a complete success and to have amply justified its inception. Up to the time the present list was issued upward of 450 preparations of diverse type have been admitted to the list.

The idea of the inception of the scheme dates back apparently to the Imperial Mycological Conference of 1934 and may have taken its rise from a scheme which had been in operation in Malaya for some years previously whereunder an official list was prepared of fungicides approved for the treatment of the disease of the tapping panel known as Mouldy Rot (*Ceratostomella fimbriata*).

An essential feature of the scheme is its voluntary nature, and it is believed that in this largely resides its strength, particularly under British conditions.

In France a somewhat similar scheme also exists, but in this case official approval of any product of this type offered for sale is obligatory by law. According to M. R. Poutiers, Head of the Crop Protection Service of the French Ministry of Agriculture, speaking at the Fernhurst Conference last year, the number of applications for approval received up to January 1, 1951, amounted to 4,222, but of these only 1,612 had then been approved and allowed to be put on the market; of the balance, 1,827 products had been refused, the remainder being still under consideration.

The contrast with the British position is striking; it would seem to argue much greater activity on the part of our Gallic neighbours in devising and manufacturing plant protection products combined with a somewhat lesser regard for their reliability and efficacy.

Commonwealth cotton

AT the Annual General Meeting of the Empire Cotton Growing Corporation, a body which we need hardly remind our readers exists for the express purpose of assisting to increase cotton production within the countries of the British Commonwealth and the Anglo-Egyptian Sudan by providing facilities for research and investigation, the Chairman of their Council, Mr. Alfred Littlewood, emphasised the marked progress which had been achieved since the Corporation was founded 30 years ago.

For the year 1950-51 total cotton production in the regions with which the Corporation is connected amounted to the record figure of over one million bales of 400 lb. as compared with 166,000 bales in 1921-22. Of this production close on half a million bales came to England representing roughly 23% of the total imports of raw cotton.

When one remembers that at the commencement of the present century production of cotton in the British Empire, apart from Indian production, was effectively non-existent, the progress made in the interval is very impressive.

More than ever is it desirable that dependence of the sterling area on imports from the dollar area should be lessened and in this direction the contribution capable of being made by Commonwealth-produced cotton is very considerable.

It is, moreover, very satisfactory to learn that, despite the recent drop in raw cotton prices, the Governments of Uganda and Nigeria have this year agreed to pay native African cotton growers the same prices for seed cotton as they received for the previous crop. This should help to maintain production at a steady level; it has been made

possible as a result of the wise and timely action on the part of these Governments in curbing the local prices for cotton during the period of excessively high world prices and the creation of price stabilising funds.

The creation of similar machinery in other territories can have a profound effect in ensuring the continued maintenance of cotton production at the existing and at expanding levels in years to come.

A striking feature is the manner in which cotton production in Nigeria has expanded of recent years. This territory has for long possessed a not inconsiderable local cotton spinning and weaving industry by somewhat primitive native methods, export production representing the surplus not required for local consumption. During the war, moreover, cotton production was reduced owing to concentration on foodstuffs. Since then rapid development of cotton growing has occurred, largely as a result of efforts by the Corporation's officers, which has posted specialists to work on cotton problems in the territory.

As a result cotton production has expanded from 21,000 bales in 1947-48 to 100,000 bales in 1951-52.

Superstition and sterling in India

A CORRESPONDENT who has recently returned from India has some trenchant things to say about the effect of religious observances and superstition on that country's economic position, and we think it of interest to summarise his remarks.

He emphasises that owing to her inability to develop fully her agricultural and industrial potential, India continues to add to the drain on foreign exchange. She is unable to feed herself, her population is growing at the rate of five million per year, while her food output is static at best; already her food imports total nearly five million tons, next year they will be greater.

Unless something drastic is done the ultimate prospect is starvation and economic collapse, with disastrous repercussions on the rest of the world. The need is for (*a*) restriction of population increase, (*b*) education of the Indian peoples to use foods to which they are not accustomed or from which they are at present debarred by superstition or tradition, and (*c*) increased food production.

In regard to (*a*), family restriction is obstructed by the belief that a father's well-being in the next world depends on his funeral rites being performed by his son. Consequently, fathers do not feel safe, having regard to the mortality hazards in India, unless they have several sons. This leads to large families and to consequent uneconomic fragmentation of holdings which among other things makes impossible the adoption of modern agricultural methods.

In regard to (*b*), Hindus will not eat flesh or even fish, milk or eggs, and this limits the possibilities of developing the great potentialities for poultry raising and pisciculture. Cattle cannot be made use of as food by reason of their sacred character, although the country swarms with them. Even traditional and untabooed foods, such as grains, are the prey of superstition since heavy toll is taken of them by swarms of monkeys, peacocks and the like, which, being sacred, cannot be killed. Even plagues like locusts may not be dealt with by reason of the superstition against taking life.

It is true that great efforts are being made to encourage increased food production and the Colombo plan is an example of this, but in face of such handicaps how can full success ever be attained ?

It seems, indeed, that unless a courageous and determined propaganda campaign is undertaken to teach Indian cultivators to abandon their superstitions, many of which owe their origins to economic circumstances which have long since disappeared, there seems little prospect of India ever developing to the stage of prosperity which indeed she is intrinsically capable of achieving, and of becoming the strong pillar of a world economy which undoubtedly she should be.

Sudden Death disease of cloves

ON another page of this issue there is reviewed the Annual Report of the East African Agriculture and Forestry Research Organisation; in it special mention is made of the work of the clove research team which in Zanzibar has been investigating the disease problem which has been so fruitful a source of worry to clove growers in that dependency—the largest producer of cloves in the world.

Readers may remember that two years ago there appeared in WORLD CROPS two articles by Mr. R. O. Williams* which reviewed the clove industry in Zanzibar and discussed the disease position. There are two major maladies which attack the clove tree in Zanzibar. One known as ' die-back ' reduces yields but rarely is fatal; the other, known as ' sudden death,' causes the death of fully grown trees with dramatic and catastrophic suddenness, usually with little or no previous indication that anything is amiss.

Many plant pathologists and other specialists attempted to clear up the mystery of ' sudden death ' but without success, the verdict of each succeeding specialist being that it could not be attributed to the group of causative agencies in which he specialised. As a result there arose, one might almost say by default, a sort of conviction that it must be due to a virus. But this, too, proved disappointing as a hypothesis, since despite efforts to transmit the virus by all the techniques known to the virologist, only negative results were obtained. Obviously it was time to think again, and this the EAAFRO team, under the direction of Dr. F. J. Nutman, proceeded to do. After long researches they eventually succeeded in demonstrating that despite the claims to the contrary of earlier authorities there were indications that the disease might be caused by a fungus pathogen which has since been identified as a species of Valsa. This is invariably associated with ' sudden death.' The behaviour of this fungus after the death of infected trees and particularly the appearance of fructifications on the trunk, is in accord with the known manner of spread

* ' The Clove Industry of Zanzibar Protectorate,' WORLD CROPS, 2, 143 and 198.

of the malady and suggests possible methods of arresting its spread. The matter is still under investigation and fuller publication is promised in due course.

Meantime the other malady of clove trees—' die-back '—has also been shown to be caused by a fungoid pathogen—a species of *Cryptosporella*—and measures have been demonstrated which if properly put into practice can arrest the spread of the disease. Moreover, it has also been shown that this same fungus can also cause the deaths of young clove trees in a manner closely resembling sudden death.

It would therefore seem that after an interval of very nearly 30 years' work this mysterious complex of diseases may at long last be in a fair way to being cleared up.

Imported plant pests

THE first number of *Plant Pathology*, the British Ministry of Agriculture's new scientific journal, included a paper of international importance from W. C. Moore, M.A., of the Plant Pathology Laboratory. This dealt with the principles that should underlie all plant import and export regulations aimed at minimising the risks of pest invasion. On the whole, this far-reaching problem is at present tackled by importing countries—it is for them to impose such safeguarding measures as they think fit. In practice such regulations have not always been biologically sound; sometimes they have been irrationally devised out of fear rather than proven knowledge, and occasionally they have been regrettably used to give protection to home producers as a kind of undeclared economic tariff.

A two-way approach is required. It should also be the obligation of every exporting country ' to take all reasonable steps to prevent the export of insects, fungi and other organisms likely to harm crop plants.' This must be matched with an adequate inspection service in all importing countries. It can never be enough for importers to rely upon health certificates issued by exporters. If these two basic principles are universally accepted, highly qualified staffs for operating them would have to be recruited and trained. The scientific principles that should guide all these services ought to be arrived at by consultation between technical officials and scientists; ideally, an international code should be prepared. This could, and should, leave considerable room for separate agreements between particular countries; for there are wide variations in risk of pest invasion in different areas of the world and in other cases a country may be susceptible to pest invasion only at certain periods of the year.

Nothing can entirely eliminate the risks of international pest movements. Regulations based upon the fullest and soundest biological knowledge cannot affect the pests that are transported on aircraft or ships; air currents can carry spores and insects; plant viruses can be undetectably present in crop merchandise. It is most important not to regard these loopholes of natural circumstance as reasons for under-valuing the need for regulations. Chance that is uncontrollable may indeed cause single or small-scale pest invasions, but generally it is possible to prevent pest establishment, *e.g.* the Colorado beetle's many attempts to establish itself in post-war England; the real risk of pest establishment is associated with constant or frequent introductions and only soundly designed regulations can hope to minimise this danger.

CHANGE OF ADDRESS

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A pioneers' risk?

HAVE modern grassland management methods and the new strains of grasses and clovers caused the marked increase in husk worm trouble now being reported in Britain? This is a question forcibly raised in a paper by Dr. Taylor in the *Journal of the British Ministry of Agriculture* (1952, June, **59**, 3, 109-112), and the evidence certainly suggests that in making two blades of grass grow where one grew before, perhaps hundreds of husk worms have also been made to take the place of a former few. The husk worm is parasitic in the air passages of animal lungs. It does not grow there, however; the minute worms hatched from eggs pass out with dung and their survival depends upon the conditions in the deposits of dung. They require about five days of life and growth before they are robust enough to survive if picked up by the grazing animal. If in that five days the surface of the dung dries quickly, thus shutting out air and minimising the moisture available, most of the infant husk worms die; but if the dung remains moist and uncaked, most of them develop. The lush foliage of modern ley pastures produces a ' micro-climate ' at the soil surface that favours the growth of husk worms. Furthermore, controlled grazing, confining cattle to limited areas, increases both the dung heaps and the cattle's chance of acidentally picking up the worms. It is tentatively believed, therefore, that the rise in incidence of husk, especially its almost new incidence in adult milking cows, is a direct consequence of modern grassland methods.

With non-intensive grazing—with three or four acres for every cow—husk worms were automatically controlled. It is unthinkable that all the advances towards intensive grazing should be nullified by a parasitic pest; in any case, the extent to which husk disease is becoming a menace is not yet serious enough to offset the great benefits that have flowed from modern leys and strip grazing. A good remedy for husk worm infestation is obviously needed and veterinary research in Britain is urgently tackling this problem.

THIS MONTH'S COVER

Harvest time in South Sweden. This picture was taken from the slopes near Gränna, overlooking Lake Vättern. An article on the cultivation of vegetable oil crops in Sweden appears on the opposite page.

(Photo: Swedish Travel Bureau, London)

The Cultivation of Winter Rape and other Oil Plants in Sweden

G. ANDERSSON, Ph.D.
Swedish Plant Breeding Station, Svalöv

Like many other European countries, Sweden suffered severely during and after the war from shortage of vegetable oils and fats. To meet this shortage the Swedish farmers, with governmental encouragement and assistance, embarked upon the cultivation of oilseeds suitable to the Swedish soils and climate, with marked success, succeeding in producing sufficient to meet the greater part of the shortage. Since the war oil-seed production has been maintained and the country has been endowed with an important new agricultural industry.

OIL plants are not a very old crop in Sweden. During the 19th century winter rape was grown, the oil being used mainly for lighting and lubrication.

The cultivation, however, did not reach any great acreage—only 3,000 or 4,000 hectares—and at the turn of the century it had totally ceased owing to the low prices of imported oils and fats.

Towards the end of the first world war and in the years 1918-1923, when fat shortage was pronounced in Sweden, the growing of oil plants was taken up again. This time, besides winter rape, white mustard and linseed (flaxseed) were also grown.

When the import of fats and oils became free however, cultivation again ceased (about 1923) and was not resumed until the outbreak of the second world war in 1939.

The area under oil plants during the first world war only reached a few thousand hectares, about the same as in the 19th century, but when cultivation was taken up again in 1939 it developed in quite another way and instead of ceasing at the end of the war in 1945, it has since increased still further. As is shown by Table 1, the total area under oil crops has increased from about 400 hectares in 1940 to 176,000 hectares in 1951. For comparison it may be mentioned that in the same year the area under sugar beet amounted to about 50,000 hectares and that under winter and spring wheat, winter and spring rye together amounted to 425,000 hectares.

Types grown

Among the different oil plants white mustard was most extensively grown during the first years, because it was considered more easy to grow than the others. Later the more valuable crops such as winter rape, summer rape and linseed became more frequent, while winter turnip rape, summer turnip rape and, quite recently, Camelina (*C. sativa*) have been grown where conditions suit them.

Leaf mustard, poppy, sunflower and soya bean have also been tried but production has now ceased, soya beans and sunflowers having proved to be too late in ripening under Swedish conditions, poppy seed too low yielding to be economic, while no varieties of leaf mustard suitable for growing in Sweden have been found.

Prices and development

The main cause of the rapid development of oil crop cultivation in Sweden has been that growers have been guaranteed sales for their whole crops at prices fixed by the Government.

To stimulate cultivation, prices during the first years were fixed at a somewhat high level in comparison with other crops. Thus, the price of winter rape during the three first years amounted to one Swedish crown per kg., about four times the price of winter wheat. Subsequently the price was reduced and reached a bottom level of 0.69 Sw. crowns per kg. in 1946. The acreage then rapidly decreased, but as the need for fats was still great, the price was again increased in 1947 and 1948 to 0.90 Sw. crowns per kg. In 1950 and 1951 the price was again reduced to 0.75 and 0.70 Sw. crowns per kg. respectively, but in 1952 the price was finally fixed at 0.90 Sw. crowns. The price of wheat has, however, increased very much during the same time and is now 25 Sw. crowns a cwt. Thus the price ratio between winter rape and winter wheat is at present the most unfavourable so far recorded, as the rape price is now only 1.8 times that of wheat. In consequence, there is at present a tendency to reduce winter rape growing, and this holds true for other oil plants as well.

TABLE 1

THE ACREAGE OF OIL PLANTS IN SWEDEN DURING 1940-1951 (HECTARES)

	1940	1942	1944	1946	1948	1950	1951
Winter rape	60	1.370	11.940	5.390	14.300	61.090	85.470
Winter turnip rape	—	—	—	430	1.020	5.640	14.420
Summer rape	—	200	8.690	6.910	23.590	46.710	32.570
Summer turnip rape	—	—	—	—	—	6.600	10.790
White mustard	—	14.000	7.710	5.240	18.020	5.640	11.070
Leaf mustard	—	—	—	40	120	—	—
Poppy	110	720	2.760	260	—	—	—
Linseed	200	1.750	13.280	8.730	21.670	33.400	20.840
Sunflower	—	40	30	—	—	—	—
Soy-bean	15	40	5	—	—	—	—
Camelina	—	—	—	—	—	80	1.040
Total acreage	385	18.120	44.415	27.000	78.730	159.170	176.200

Seed drying

In Sweden oil seeds must, as a rule, be artificially dried after harvest. Only seed of winter turnip rape and winter rape can sometimes, in dry and sunny weather, be sufficiently dried in the open air, so that artificial drying is not necessary, and all seed from summer oil plants and the main quantity of winter rape seed must be dried artificially. One of the essential conditions for the development of large-scale oil plant cultivation has therefore been the establishment of drying plants which are now spread all over the country. The total capacity of these has increased considerably during the last ten years and is now big enough to handle a crop of about 200,000 tons of oil seeds as well as the cereal crop, which is increasingly

harvested by combines and must be dried artificially.

Organisation of the industry

The effective utilisation of the full capacity of the drying plants is a link in the organisation established for oil plant cultivation, which has been one of the many reasons why it has succeeded so well in Sweden. Briefly the organisation is as follows: growers of oil seeds are organised to form the Swedish Oilseed Growers' Organisation, with branches in all counties, for which the farmers grow oilseeds on contract. The organisation buys the product from the farmers and sells it to the oil mills. It also negotiates prices to be paid for different oilseeds and after agreement has been reached the price is ratified by the Riksdag. The Growers' Association undertakes by an agreement to organise growing the crops on the terms agreed. The handling of the crop is done by a separate branch, the Sveriges Oljevaxtintres-senter. It includes representatives of the Government of the seed growers' associations, of the oil mills and of certain other organisations. It makes agreements with the drying plants, who receive the seed from the growers, dry it and, if necessary, clean it and transport it to an oil mill. The Growers' Association receives a certain percentage of profit for its work, which is mainly used to finance field trials and research work.

Production

Oil plant cultivation has been and is of great importance to the country's supplies of fats and oils. During the last war, for example, Swedish oilseed growers contributed the major part of the total amount required, while today production covers total requirements of edible fat and considerably more than half the total requirements of linseed oil plus a large amount of concentrated protein feeding stuffs.

Table 2 shows the estimated production for 1951. For comparison Table 3 gives the total consumption of edible fats in Sweden during the years 1938-1951.

The figures for 1950-1951 are preliminary and those of 1951-1952 prognosticated.

As is shown by Table 3, consumption has increased rapidly after the last war, and from about 20 kg. per head prewar it is anticipated that in the near future it will reach 30 kg. per head, equal to the consumption in the neighbouring country of Denmark. Consumption has, to a great extent, changed from butter to margarine, which is cheaper. In 1946-47 only 19% of the total edible fat consumed was margarine but in 1947-48 the figure was 33%

TABLE 2

PRODUCTION OF OILSEED IN SWEDEN DURING 1951

Plant species	*Acreage hectares*	*Yield Kg. hectare at 9% H_2O*	*Total yield Tons*	*Manufactured output of oil %*	*Oil quantity Tons*	*Feed %*	*Meal Tons*
Winter rape ..	85.400	1.670	142,600	42	60,000	53	75,600
Winter turnip rape ..	14.400	1.040	15,000	42	6,300	55	8,300
Summer rape	32.600	1.040	33,900	38	12,900	59	20,000
Summer turnip rape ..	10.800	650	7,000	35	2,500	62	4,300
White mustard	11.100	1.170	13,000	27	3,500	70	9,100
Camelina ..	1.100	1.100	1,200	38	500	59	700
Total	155.500	—	212,700	—	85,700	—	118,000
Oil flax ..	20.800	1.100	22,900	35	8,000	63	14,400
Total	176.200	—	235,600	—	93,700	—	132,400

TABLE 3

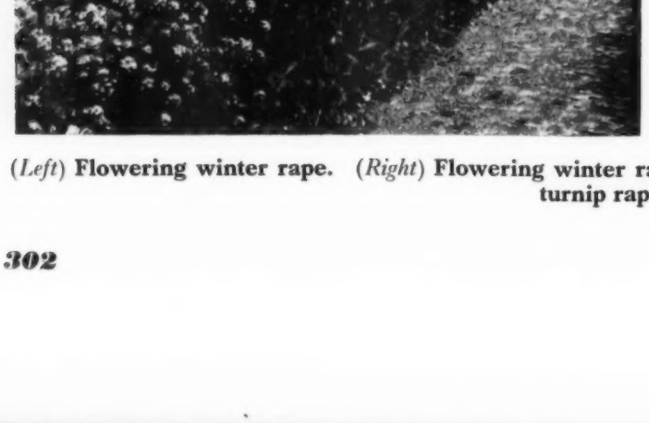
CONSUMPTION OF EDIBLE FAT IN SWEDEN, 1938-1951 (IN MILLIONS OF KG.)

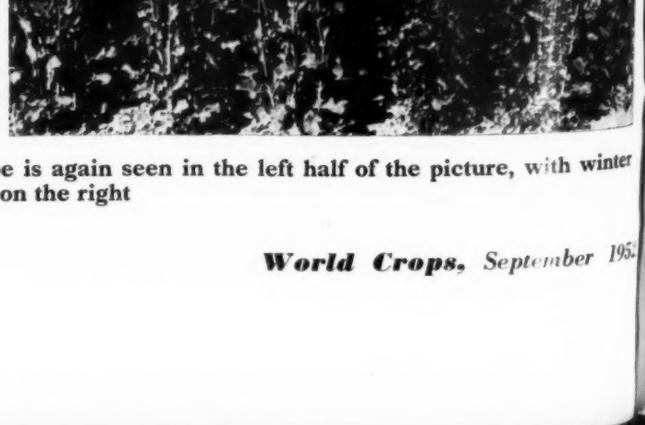
	1938-39	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52
Dairy butter	54.6	101.1	90.0	92.1	94.3	85.6	81.5
Home-made butter ..	16.8	5.6	5.6	5.6	2.6	2.4	2.2
Household margarine }	59.2	15.4	35.4	41.7	52.8	63.7	73.1
Bakery margarine }		9.3	11.5	19.0	23.6	23.1	22.2
Other edible fats ..	7.5	3.6	4.4	4.3	3.5	3.5	2.5
Edible fats, total ..	138.1	135.0	146.9	162.7	176.8	178.3	181.5
Index 1938-39=100 ..	100.0	97.8	106.4	117.8	128.0	139.1	131.4

TABLE 4

YIELDS OF DIFFERENT OIL CROPS IN SWEDEN DURING 1941-1950, KG. PER HECTARE (AT 18% MOISTURE)

Species	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	*Aver.*
Winter rape ..	1,523	1,981	2,432	1,508	1,459	1,796	1,091	2,125	2,002	1,804	1,778
Winter turnip rape ..	—	—	—	—	1,117	1,188	834	1,023	1,091	1,210	1,077
Summer rape	—	1,518	1,290	979	1,075	1,009	1,336	1,161	1,264	1,317	1,217
Summer turnip rape ..	—	—	—	—	—	—	—	959	929	899	929
White mustard	1,145	1,279	1,203	974	958	1,072	1,196	1,130	1,044	1,017	1,102
Poppy ..	509	892	777	806	740	554	294	—	—	—	653
Linseed ..	691	1,122	1,389	1,285	1,419	945	1,139	1,472	1,202	1,252	1,192
Camelina ..	—	—	—	—	—	—	—	—	—	1,603	1,603





(*Left*) **Flowering winter rape.** (*Right*) **Flowering winter rape is again seen in the left half of the picture, with winter turnip rape on the right**

Plants of winter rape (*left*) and winter turnip rape (*right*)

and in 1951-52 it is expected to amount to 52.5%.

The estimated total margarine consumption amounts, as is shown by Table 3, to 95,300 tons ; as margarine contains 82% fat this is equivalent to 78,100 tons of oil. When ' Other Edible Fats ' are added, the estimated consumption of vegetable oils in Sweden amounts to 80,600 tons and accordingly the total production as shown by Table 2—85,700 tons—very easily meets the total demand for vegetable fats within the country.

Quality of the produce

Vegetable oil produced in Sweden is of very high quality. It is possible that the linseed oil is a little uneven in this regard as the seed delivered at the oil mills comes from a great number of fields, in many cases not very carefully tended ; it is, however, possible to produce in Sweden enough oil of very satisfactory quality.

White mustard oil has proved superior to most imported oils when used for mayonnaise, while rape oil, mainly used for margarine, seems also to be well-suited for this purpose.

The Swedish margarine industry, however, does not use only Swedish oils and at present Swedish margarine consists of 50% coconut oil, 35% saturated fat (rape fat or whale fat, or both) and 15% unsaturated rape oil. Leading margarine manufacturers are of the opinion that the rape fat percentage could be increased to 70 without quality deterioration. In the event of imports of coconut oil being stopped for any reason Sweden would be prepared to make its margarine from oil exclusively produced within the country.

Consequent on importation of copra certain quantities of rape seed and oils have been available for export. Western Germany took most of it but France, Great Britain and Denmark have also bought certain quantities. Actually 36,000 tons of rape seed *and other oilseeds* and 21,000 tons of rape oil *and other vegetable oils* of the 1949 crop were exported. The corresponding figures for 1950 were 51,000 tons seed and 14,000 tons oil and for the 1951 crop until August, 60,000 tons seed and 13,000 tons oil.

Press cake for stock feed

The present consumption of concentrated cattle feed in Sweden is estimated at about 175,000 tons a year. The cake produced from oilseed grown and worked in Sweden is, therefore, a valuable contribution to the supply of concentrated cattle feeds. Rape and mustard meal it is true are considered to be less valuable as foods than meal from imported oilseeds but trials still in progress indicate that their feeding value is reasonably high, and that rape and mustard meal can be fed in larger quantities than was formerly regarded as possible. It is interesting in this connection to note that the Danes, who did not grow rape during the second world war, now intend to start growing it and that one of their primary motives for doing this is the need for protein feeds.

Foreign competition

At prices prevailing in the world market of recent years, the Swedish oil industry has been able to stand foreign competition very well. Recently, however, prices of raw fats have shown a downward tendency, and Sweden will hardly be able to export part of the 1952 crop on such favourable terms as in recent years. The Swedish government has already embarked on a more conservative policy of prices paid for oilseed, notwithstanding that the prices for cereals have risen very considerably. As a result there has been some decrease in the area planted this year and this will probably be more marked in the future. The Government has, however, in different connections, expressed the view that oilseed cultivation should be maintained in Sweden to some extent without regard to prices abroad, and that the acreage should be maintained at a level that will permit locally purchased oil to continue to be used in margarine manufacture at the present percentage.

Agricultural policy

The motives for maintaining oilseed cultivation in Sweden are many. In the first place the abandonment of oil plant cultivation would in all probability lead to over-production of cereals, which could not be sold on the world's market. Another reason for maintaining production of oilseeds is the need for war preparedness. The experiences of two world wars have convinced the Swedes of the value of being self-supporting in foodstuffs so far as possible and here the production of fats and oils is a very important item, especially so because of the high yields given by these crops in Sweden. Moreover oilseeds offer many technical advantages in cultivation. In many districts of Sweden the crop rotation is too one-sided, mainly consisting of alternations of leys and cereals. The introduction of oilseeds into the rotations in these districts is a considerable improvement.

On farms which have no cattle, which are becoming more and more frequent, seed crops have an equally favourable effect. All of them are useful precrops for cereals, partly because they are sown at distances between the rows which allow for weeding and partly because most of them are given very liberal applications of manure ; moreover, some oil crops, *e.g.* winter rape and winter turnip rape, are harvested earlier in the season than the cereals while linseed is harvested later ; this leads to a more economic distribution of labour, a great advantage in Sweden where wages are high and labour is in short supply.

To improve the outlook for oil seeds in Sweden, it is important that every effort is made to rationalise and cheapen production. Oil crops which are especially suitable for certain districts or soil types should be confined to them, the most suitable cultivation methods should be employed, control of insect pests and disease should be made more efficient and improved crop varieties, produced by systematic breed-

ing and selection, should be introduced.

Table 4 shows the average yields of the seed crops grown in Sweden during the past ten years.

Winter rape is the highest yielding and has the highest oil content, *i.e.* 40-45% at 10% water content in the seed ; it is of course Sweden's best oilseed crop and should be grown whenever sowing at the right time is possible, and climatic and other conditions are favourable for it. Winter turnip rape is hardier, ripens earlier and can be sown a couple of weeks later than winter rape. It can on this account be grown under more severe climatic conditions, for example in Middle Sweden and on the Island of Gotland, the latter district being liable to drought in early summer ; it is also grown in South Sweden when it is not possible to sow winter rape early. Among the summer oil crops summer rape is the highest yielding but the crop is very liable to attack by insect pests ; it is at present grown only in Middle Sweden, where pests are not so severe as in the South.

Summer turnip rape, being the earliest ripening of all, is especially suited to peat soils. White mustard gives fairly high yields in South Sweden where it is grown as a fallow crop, while linseed is the best oilseed crop for heavy clay soils.

Experimental work

Proper cultivation technique is essential for satisfactory crops and the Swedish Oil Plant Growers' Organisation carries out each year an extensive programme of experimental work on cultivation problems. As most oilseed crops are very liable to insect attack, adequate control measures are very important, and on this account the Central Plant Protection Bureau, with financial support from the Swedish Oil Plant Growers' Organisation, carries out experimental work on protection problems. of most of the insect pests of the oil crops. Plant breeding with oil crops seems likely to produce better varieties, and intensive work in this direction is also being carried out, notably by the Swedish Seed Association at Svalof, with considerable financial support from the Swedish Oil Plant Growers' Organisation. This work has already yielded substantial results, for instance the new winter rape varieties, Svalof's Matador and Svalof's Tenus, are respectively higher yielding and hardier than any other varieties grown in Sweden.

Thanks to these and similar measures the oilseed industry in Sweden can be regarded as firmly established, while the prospect is for steadily increasing yields and greater prosperity in the future.

A field of maize near Wageningen, Holland

Hybrid Maize in Holland

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We have in WORLD CROPS *on several occasions mentioned various aspects of hybrid maize production, and commented on the attempts now being made, under the auspices of FAO, to introduce hybrid maize into various European countries. Striking results have been achieved in Holland, a country formerly considered to be too far North for the successful cultivation of maize as a grain crop. In the following article the results so far achieved in this direction by the Dutch are described and discussed.*

MAIZE is a relatively new crop in the Netherlands, although attempts to use it as a grain crop were made more than a hundred years ago. These failed, however, on account of lack of information and research.

Maize has, however, long been grown on small fields in the south western part of the country as a fodder crop for horses during the strenuous work of sugar beet harvesting and ploughing in the autumn. For this the tall growing, late maturing so-called Virginia horse-tooth maize was planted. Much seed was used to get a dense leafy crop which was cut and fed direct so soon as the tassels showed.

Historical

There were a number of motives for maize growing experiments which started in 1934. The economic depression was then very severely felt by small farmers on light soils, who had derived their main income from eggs, milk and bacon, the food to produce which was partly imported and partly homegrown. Among the imported feeds maize took a leading place, an average of one million tons coming from abroad every year. The main home-grown grain grown on sandy soils in the Netherlands is rye. There were two reasons for replacing part of this by maize : firstly, maize yields 30-40% more grain and secondly, it is a much more satisfactory feed than rye. Accordingly maize was chosen to improve the productivity of these small farms.

Experiments were started with early maturing German flint varieties : Pfarrkirchner, Chiemgauer, Mecklenburger. Dutch breeders selected strains of these adapted to the climatic conditions. American varieties were also tested but most of them ripened too late to be safe.

In 1937 the acreage farmed was 2,000 acres and by 1940 it had increased

Standard type of crib used in Holland for storing maize cobs

4,400 acres. The war could not prevent a further increase to 11,000 acres in 1944, of which nearly 40% was planted with seed of Dutch selections. The new crop established itself mainly in the south-eastern part of the country ; general acceptance of it was hampered by unfamiliarity with growing methods ; production costs, specially harvesting costs, were high, mainly because the early pollinated flint varieties give rather small plants of which 36,000-40,000 per acre are needed to produce good yields. The ears are small and are placed only 1½ to 2 ft. above the ground, consequently harvesting by hand involves much stooping while the necessity for building maize cribs for drying and storing was also considered a drawback.

Introduction of hybrids

After the war maize growing got a new stimulus from the introduction of hybrids from the U.S.A. In 1946 and 1947 hybrids from Wisconsin, Minnesota, North Dakota and Canada were tried. In 1948 FAO distributed a collection of American hybrids and inbreds to all the member states interested. Although two private breeders had already started inbreeding their own material and had introduced American varieties on a small scale, this distribution marks the commencement of maize breeding in the Netherlands.

Much information on the growing, breeding, harvesting, handling and storing of hybrid corn was collected by the author during a study trip in the U.S.A. in the summer of 1950. This trip, sponsored by the Technical Assistance Division of F.C.A. (at present M.S.A.) and the many contacts made with American experts and European workers at the FAO Hybrid Maize Meetings were and are extremely useful.

A further stimulus was the mechanisation of picking, made possible by the suitability of hybrid varieties for this. In 1948 the first three cornpickers were imported and by 1951, 50 cornpickers were in action. All this resulted in an increase of the acreage under maize in 1951 to 28,000 acres, of which 72% was sown with hybrid maize.

Seed production

A difficulty in the past was seed production, but the application of American methods has so improved home grown maize seed that its quality today is equal to that of imported seed in respect of germination and vigour of growth. The production of hybrid seed in Holland was started in 1947, and by 1950 the first Dutch experimental hybrids entered variety trials; 100 tons of homegrown seed were used in 1950 to sow 10,000 acres in 1951, the results being in no respect inferior to those obtained with imported seed. This encouraged breeders to further expansion and in the spring of 1952 about 240 tons of homegrown seed were available of which about 15% represented new Dutch hybrids.

Climate limitations

As the Netherlands have a marginal climate for maize growing there are many problems to solve. Moreover, Holland is a small country, but there are considerable climatic differences in different areas. As a whole, the growing season is long but cool, spring begins early, but temperatures rise slowly. This lengthens the period between sowing and ripening. The America hybrid Wisconsin 240, which in America needs about 110-120 days from sowing to maturity, takes at least 150 days in Holland. This does not interfere, however, with its productivity, and its yield in most years is as high under favourable conditions as in Wisconsin.

The warming up of the topsoil to 10° C. or more, which enables the seed to germinate, does not occur until the second half of April, while the low temperatures of the second half of October as a rule gradually slow down the ripening process. A late wet spring may make late sowing advisable, but sowing before or about the first of May is the rule. Night frosts in May are harmless and cause no damage to maize, but early night frost in October, specially after a cool September, will kill the leaves and almost stop the drying out of the seed.

Clearly maize needs to be given as long a growing period as possible to obtain high yields, therefore early sowing is preferable. Healthy, well-matured seed favours this, while treatment with seed protectants, such as Arasan or Fernasan, is advisable. All maize seed entering the trade in Holland has to pass a low temperature incubation test, on the lines of the American ' cold test,' to determine germination capacity under adverse conditions. So far experience indicates that good seed must show at least 75% germination in the cold test and 90% or more at optimum temperatures. Therefore, varieties are wanted which are able not only to endure cold conditions, but to germinate and emerge under this. Our breeders have achieved remarkable results in this respect with the hybrids Goudster and Amtwee and several others still in the experimental stage. These, although earlier in maturity, yield as high or even higher than the best American and Canadian hybrids probably by virtue of their quicker start.

Soil conditions

Tilth and soil structure are more important than soil type. Wet soils, warming up slowly in spring, are not fit for maize, regardless of whether they are sand or clay, but well drained soils in good tilth are good. A pH of at least 5.2 is necessary and a high organic matter content is favourable. There is an interaction between soil and climate; good soil conditions protect the seed and seedlings against adverse weather conditions. Farmyard manure, compost or green manure enhance this effect.

The number of plants per acre is a very important yield-determining factor. Wide spacing with 10-12,000 plants per acre, as practised in the U.S.A. cornbelt, cannot give maximum yields of early maturing hybrids under Dutch conditions. The

results of several spacing experiments show that 28,000 plants per acre is the optimum for the hybrids grown at present. The best distance between rows is 27-40 in. The later maturing and taller growing hybrids, however, as a rule prefer somewhat smaller plant populations, *e.g.* 24,000 plants per acre or even a little less. The earliest maturing hybrids will sometimes give better results with 32,000. The early open pollinated flint varieties need 36,000-40,000 plants per acre with a distance between rows of 24-30 in. In a late spring like 1951 no more than two-thirds of the seeds may produce plants, even when soil conditions are reasonable; this was shown on last year's experimental field of the General Netherlands Inspection Service for Seeds of Field Crops, and the best plan is to sow 40-50% more seeds than the number of plants wanted. If the number of plants is too great, thinning out is necessary, because too dense a stand will always give disappointing yields.

Harvesting

Harvesting and drying are perhaps the most important problems. Before and during the war hand-picking and storing in a drying shed was the only method used. Picking many small ears, low on their stalks, took 80 or even more hours of hand labour per acre, but it must be admitted that the Dutch have not acquired proper skill for this work, although some improvement has been achieved. The knack of doing this with a minimum of effort, as the American ' corn-huskers ' do it, is still unknown in Holland.

Hybrids, with a few large ears high on the stalk, are easiest to pick. That and improvement has decreased the work of harvesting.

As a rule the ears are collected in baskets or bags, put on a wagon and brought to the shed. A further improvement practised on a few farms is driving the wagon alongside the picking team furnished with a so-called ' bangboard.' The men throw the ears sideways on the wagon and the ' bangboard ' prevents the ears being thrown over the wagon.

Mechanised picking

Since 1948 a rising interest in mechanisation, using American ' cornpickers,' has developed. Up to now only one-row pickers are in use because two-row pickers need a tow-width of 40 in., which is not customary in practice.

The cornpickers at present used in Holland belong to three types:

1. The *picker-husker* with a pair of picking rolls and a *separate ' husking bed,'* which tears the husks off the ears. This husking is not always satisfactory, perhaps because the husks are tight and tough in the humid Dutch climate. The correct adjustment of the picking and husking rolls is still a difficulty, but when a driver succeeds in adjusting his machine properly satisfactory results are obtained.

2. The *picker-husker* with *combined picker-husker rolls*. These machines have picking rolls with an upper part designed for husking. Under Dutch conditions the husking capacity is poor but the picking can be very satisfactory.

3. The so-called *snapper*, without any husking parts. This type is the most simple in construction and therefore the cheapest. It performs very well.

A possibility is the use of a stationary husker, which can be used in combination with a team of men picking ears without removing the husks. This method requires 30-35 man-hours of labour per acre. A stationary husker can also be used in combination with a mechanical snapper.

If a cornpicker is properly handled and adjusted the picking is as good or even better than picking by hand. Two or three men operating a cornpicker are able to pick and drive home the yield of three to five acres (a day) according to the type of picker and the conditions of crop and field.

For economical use of a picker fields should be at least 2½ acres in size and 5 acres or more as an average. The use of a row width of 40 in. reduces the travelling of a picker and the time and cost needed to harvest an acre of maize. There is also a difference in the suitability of varieties for mechanical picking. Stiff-stalked varieties with ears fairly high and with a broad lower end, not much tapering to the tip, are preferable. The slender, low-placed ears of the open pollinated early flint varieties cannot be picked mechanically.

Drying the crops

The moisture content of a ripe ear of maize under Dutch conditions is 35-40% in the kernel and 55-60% on the cob. It is clear that precautions are necessary to prevent spoilage of such a moist product. The cheapest way to dry maize up to now is in a drying shed, narrower than the American ' corncrib.' The reason for this is the high moisture content of the ears and the high humidity of the air during winter months. Under Dutch conditions a maize shed must meet the following requirements:

1. The shed must be built of poles with walls of wire netting.
2. The walls must be 2 ft. apart.
3. The floor must be high enough above the ground and well protected to prevent damage by rodents. As a rule, 2 ft. elevation and the adjustment of ' collars ' around the poles under the floor is sufficient.
4. The situation of the shed must be such that the wind can blow freely through the mass of ears.
5. A thoroughly watertight roof is necessary.

Hand with an American thumb hook used for corn husking

This type of shed is very long. An acre of good maize will yield 7,000-9,000 lb. of ears, which will need a shed 7 ft. high and 18-22 ft. long. About 50% of the weight of the ears at harvest will be the yield in dry grain.

In the maize shed the ears lose moisture rapidly during the first weeks, but after that more steadily. By the middle of December the moisture content of the grains will be 22-25% and will almost remain at this level until the beginning of March. Then it decreases more quickly again and reaches 15-17% at the end of April. Dry maize can be shelled in an American type of ' cornsheller ' or in an ordinary threshing machine with a cylinder speed of 400 r.p.m.

For farmers who feed their maize on their own farms this shed is the best and cheapest solution of the drying and storing problem, but farmers who want to sell their maize often need to dry their crop more rapidly.

To meet this a new method of harvesting and drying has been developed in which the ears are picked with the husks on and immediately threshed. Up to now

The hook pulls away the husks for the right hand to grasp the exposed cob

only an ordinary threshing machine has given satisfactory results. For this it has to be adjusted, reducing the speed of the cylinder to 250-350 r.p.m., using worn-off bars and operating the straw walkers at normal speed are the most important requirements. If the maize is too wet, damage will be great. Much depends, however, on the machine and its operator.

Obviously, artificial drying has to follow threshing as soon as possible. This can be done in an ordinary grain dryer, but if so the capacity will be reduced to one-third or one-fourth as compared with the drying of small grains.

When ripening is retarded by unfavourable weather the high moisture content of the maize makes it a very hazardous procedure as was seen in many cases in 1951. It is certainly not a cheap method and it makes heavy demands on the capacity of the normal types of drying equipment.

Prospects

There are possibilities for further improvement and the best undoubtedly is the growing of still earlier maturing varieties, in which case the moisture content of not more than 35% in the field can be looked for.

To enlarge the capacity of drying equipment and reduce costs a combination of drying in a shed and artificial drying is now being developed. For this purpose sheds are built for only half the crop. This half is picked early and brought into the shed. After about three weeks the moisture content will be 30% or even lower when threshing and drying is much cheaper and gives better results. After the first half is finished the second half can be brought into the shed or immediately threshed and dried.

Summary of alternative harvesting methods

Summarising present maize harvesting methods in the Netherlands gives the following outline:

(*a*) Drying the whole ears in a drying shed, for which the ears must be well husked. The possibilities are: (1) Picking and husking by hand; (2) use of a picker-husker; (3) picking by hand and husking with a stationary machine; and (4) picking with a snapper, husking with a stationary machine.

(*b*) Artificial drying and threshing immediately after picking. The husks have to stay on the ears. Therefore we may: (1) Pick by hand without husking; or (2) use a snapper.

(*c*) The combined method of shed drying and artificial drying, which requires the same harvesting methods as (*a*).

Maize growing in Holland has met with many problems, of which at present enough are solved to make it a paying proposition. Other improvements, specially in the breeding of new varieties, are beginning to appear.

Sir Bernard Keen on EAAFRO

The Director of the East African Agricultural and Forestry Research Organisation, Sir Bernard Keen, recently gave an interesting talk on the work of the Organisation, while on a visit to London. Readers may remember we reviewed their Annual Report last October.

The potentialities of cassava cultivation as a reserve crop were mentioned by Sir Bernard as holding out great possibilities for cultivation on a large scale. Ten years' breeding work at Amani (headquarters of the old East African Agricultural Research Institute which has now been absorbed into EAAFRO) have produced hybrid varieties of cassava having much thicker roots than the original varieties.

Hercules Expansion

A new biological laboratory will shortly be constructed by Hercules Powder Co. at its experiment station near Wilmington, which will enable the company to expand considerably its work in the biological, botanical and agricultural fields. It is expected the laboratory will be ready for occupation by April 1953.

The project will comprise a main laboratory building and two greenhouses. The cost is expected to be in the neighbourhood of $400,000.

Dr. E. N. Woodbury, chief entomologist, will be the head of the new laboratory and a staff of approximately 15 people will be employed.

Applied research on insecticides, fungicides, herbicides, and defoliants will be carried on in the new building; plant diseases, and seed and soil treatments will also be studied.

Greenhouses equipped with automatic controls will assure uniform conditions for growing a variety of plants.

International Grasslands Congress

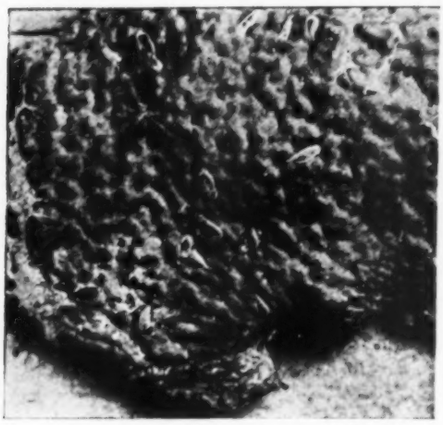
More than 200 scientific papers on the importance of grassland management to food production are to be presented at the Sixth International Grasslands Congress during the week of August 17 at Pennsylvania State College. Agricultural authorities representing Great Britain, Costa Rica, India, New Zealand, the United States and the FAO will present papers at the first plenary session.

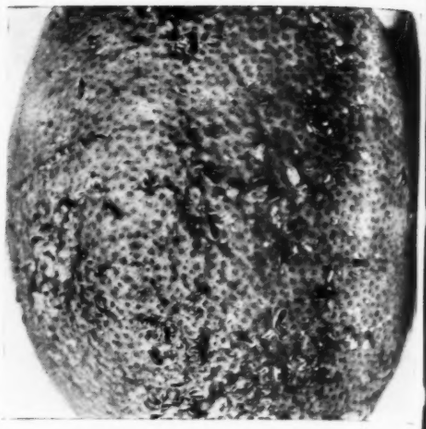
Fifty-three delegates from 26 countries have indicated they will attend.

Attention will be focused on a more balanced agricultural economy, conservation of soil and water resources, and a more abundant production of meat and livestock products. The sessions, it is reported, will carry forward the emphasis placed by the Fifth International Congress, held in 1947 in the Netherlands, on the need for working co-operation among various national groups and institutions on grasslands problems.

Technical News

'Large-scale Earthmoving Machinery on Arizona Canal Operations' is the title of an article in the current issue of *Muck Shifter and Public Works Digest*. Also in this issue and of interest to WORLD CROPS readers is the second part of E. W. Broughton's article on Modern Multi-purpose Excavators. *Food Manufacture* this month includes articles on 'Lecithin in Food Processing' and the 'Chemistry and Physics of Macaroni Products.' 'Vitamin B12 and Antibiotics in Animal Nutrition' is the title of an article in *Manufacturing Chemist*; antibiotics also form the subject of the regular 'Progress Reports' feature. *Chemical and Process Engineering* contains a review of distillation methods.





(*Left*) **Mussel scale on citrus** (*Centre*) **Citrus scale** (*Right*) **Mussel scale on lemon, adult and young stages**

The Diseases, Pests and Hazards of Growing Citrus Crops in Spain

E. SANCHEZ BUEDO
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ALTHOUGH the cultivation of herbaceous plants has great importance in the Spanish agricultural economy, the cultivation of fruit trees is no less great.

The products of the first are almost entirely consumed within the country, and the only exports are early varieties of potatoes and saffron, ground pepper (cayenne pepper), onions, tomatoes and melons.

On the other hand, the crops from bush and tree plantations are those which in their natural state or when processed constitute the bulk of Spanish agricultural exports and are the chief source of foreign currency, so necessary for the whole economy.

Amongst the very varied agricultural production of Spain, whose geographical situation, orographic and climatic characteristics make it suitable for the widest diversity of crops (from those of the subtropical zone to those of the cooler regions), the products best known are oranges, lemons, almonds, raisins, wine and olive oil.

The very considerable importance of fruit plantations is the reason for the great attention which agriculturists give to their cultivation, not only in the tilling and fertilisation of the soil, but also in the prevention and control of diseases and pests which attack the crops and not only reduce the quantity of fruit obtainable in a normal year, but also the market value of the fruit obtained.

Citrus crops

The areas covered by the different species cultivated are as follows:—

	Hectares
Oranges	70,000
Mandarines	6,600
Lemon trees.. ..	3,800
Grape fruit	60

(1 hectare = 2.46 acres)

The plantations extend along the coast of the Mediterranean and South Atlantic, from the province of Tarragona to that of Huelva (both inclusive) together with the Balearic Islands, although more than two-thirds of the oranges and mandarines are grown in the provinces of Valencia and Castellon. For lemons the provinces of Murcia and Malaga are the chief. The bitter orange, intended for the preparation of marmalade, is planted almost exclusively in the province of Seville.

This year's production will, it is estimated, reach 900,000 metric tons of oranges. In a favourable year it may reach 1,200,000 tons and in a bad one it is usually below 700,000 tons. The production of mandarines varies around 30,000 metric tons and that of lemons 50,000 tons.

The potential demand for oranges from home consumers is some 400,000 metric tons, that is to say, about 500,000 metric tons can normally be exported. There is little home demand for mandarines, and some 40,000 metric tons of lemons can be exported after leaving the home market well supplied.

Insect pests

The most serious damage suffered by the citrus crops is produced by a group of sucking insects known technically by the name 'coccids' and more commonly as scales and mealy bugs. These insects have their body protected by a more or less hard shell, and we will classify them according to the nature of this protective coat:

(*a*) With hard shield or shell: *Chrysomphalus dictyospermum* (red scale), *Aspidiotus hederae* (white oleander scale), *Lepidosaphes gloverii* ('serpeta fina,' Glover's scale), *Mytilococcus gloverii* ('serpeta gruesa'), *Parlatoria zizyphus* (black parlatoria scale).

(*b*) With hardened tegument (false shell): *Ceroplastes sinensis* ('caparetta blanca'), *Saissetia oleae* ('caparetta negra'), *Coccus hesperidum* (brown scale).

(*c*) With a powdery or waxy coating: *Pseudococcus citri* (vine mealy bug), *Icerya purchasi* ('fluted scale').

These pests are not equally developed in all the regions where the citrus crops can be cultivated. The great variety of climatic conditions and soil which characterise Spanish agriculture are reflected in the biology of numerous insects; for example, *Mytilococcus pinnaeformis* ('serpeta'), which causes such great damage in the orchards of Valencia and Castellon, does not appear in the orange groves of Murcia, Seville and Cordoba.

For many years growers have not spared efforts or expense on control of pests, for they know well the influence which this had not only on the quantity of fruit harvested but more especially on its quality and appearance.

Control measures

The insects in groups (*a*) and (*b*) are controlled with hydrocyanic acid and with insecticides based on oil emulsions.

The control of the scale insects in group (*c*) cannot be carried out well with the above products, for the waxy covering prevents the penetration of the oil emulsions and makes that of gaseous hydrocyanic acid difficult. For this reason, biological control is chiefly used against them. The Plant Pathology Station in Burjasot (Valencia) supplies free, to any growers who apply, colonies of *Novius cardinalis*, an insect which feeds exclusively on *Icerya purchasi*. They also supply colonies of *Cryptolaemus montrouzieri*, an insect parasite of *Pseudococcus citri*.

Despite the increase in experiments on the use of emulsified mineral oils under normal conditions, preference is given to the use of hydrocyanic acid gas in the control of the above-mentioned pests, and this despite the great risk involved by its use. The staff engaged in the operations acquire excessive confidence in the manipulation of such a poisonous chemical until they come to the point of forgetting the most elementary precautions.

Another disadvantage of using hydrocyanic acid is the limitation imposed on its use by meteorological agents: temperature and humidity (of both soil and atmosphere), light and wind. All these, as well as the vegetative cycles of the trees, reduce the time in which it is possible to control the pest to two periods in the year: one in winter—from the completion of harvesting to the appearance of new shoots; the other in summer—from the time when the oranges, still green, are the approximate size of a walnut to when they begin to change colour.

A great increase in expense and work is involved in the use of this insecticide by the necessity, before application, of covering the trees with special canvas tents of cotton fabric which are made in octagonal form. The moving and installation of these tents require the use of poles or rods and ropes.

Cotton cushion scale on grapefruit

Chemical supplies

Of the different methods used to generate hydrocyanic acid, preference is given to the most troublesome: that of the 'jar.' Some attempts have been made to replace it by the more convenient and economical system of a large-capacity and transportable generator on wheels, but growers continue to use the first method, for they find that the action of hydrocyanic acid is more effective immediately after generation.

Red scale damage on a lemon tree

Compared with sodium cyanide the use of other products which generate hydrocyanic acid gas is limited, despite the convenience in managing them and the fact that they do not need sulphuric acid or water. Thus the use of calcium cyanide either in dust form (Cyanogas) or in pastilles or tablets (Calcid) is very limited.

There is a factory in Valencia for producing liquid hydrocyanic acid, but this method has not been extended, and the cyanides which this factory needs as raw materials have to be imported.

The serious problem which now confronts the citrus industry is lack of sodium cyanide. It depends exclusively on imports and in the last two years, despite the efforts of our competent organisations, we have not found suppliers for the 1,000 metric tons which, on an average, are needed for the citrus plantations. In order to meet this deficiency in future, great efforts are being made to produce in Spain all the sodium cyanide necessary.

On the other hand, the oil emulsions which were imported a few years ago, chiefly from North America and Great Britain, are already being made in Spain. However, their quality still requires to be improved, especially as regards unsulphonated residue and viscosity. To do this it is necessary for the Petroleum Monopoly (C.A.M.P.S.A.) to supply highly refined white vaseline oils. The casein necessary for preparing the emulsions is the only thing which it is at present necessary to import.

The oils are used generally for summer treatments.

The usual method of controlling pests is to fumigate with hydrocyanide every two years, and in the interval to apply oil. Orchards in the most favourable position are fumigated every three years, but at the opposite end of the scale there are some which are not only fumigated annually but also sprayed with oil emulsion in summer.

Costs

From what has been said the reader can easily deduce the expense and efforts needed for the protection of a citrus orchard. Fumigation with hydrocyanic acid at present involves a cost of 8 to 14 ptas. per tree, according to the size of it, but every grower is aware that, if he ceases this constant control at the end of some three years the production will be reduced to 30-40% of what it is at present, and the fruits obtained would be of very bad quality and unsuitable in appearance. Calculate the amount of this loss at the present prices of fruit, which vary from 1.60 to 2.50 ptas. per kilo.

In some years severe damage is also caused by the ' Mediterranean fruit fly ' (*Ceratitis capitata*). The difficulty of the present system of control (special flasks with poison bait suspended from the trees) is the reason for its not being controlled with much efficiency.

Fungus diseases

The fungus diseases which attack citrus crops are not very important compared with pests. Some like ' sooty mould,' caused by the fungus *Meliola camelliae*, are a consequence of the existence of ' scales,' which secrete a sugary material encouraging the development of the fungus, a black powder covering the leaves and fruits, which are thereby spoiled. Generally the destruction of the ' scales ' causes the disease to disappear but cuprous oxide sprays will control it even in the presence of scales.

The fungus *Pythiacystis citrophthora* gives rise to the disease called ' Gummosis,' manifested by the exudation of gummy matter, which is observed on the branches and trunks and at times also on the fruits. It occurs where there is an excess of moisture in the soil, preventing the normal respiration of the roots. For this reason the soil is excavated around the trunk leaving a large part of the roots uncovered to aerate them, at the same time preventing wet soil from coming into direct contact with them. The lesions already produced on trunks and branches are scraped with a sharp knife until the healthy wood is reached. The wound is disinfected with a solution of permanganate of potash and covered finally with a layer of mastic.

Physiological maladies

In Spain citrus crops also suffer from other diseases, whose causes are not well known and which we can consider physiological: such are ' *Chlorosis* ' and ' *Foliocelosis.*' It is easy to confuse them, as the symptoms are very similar: in both a yellowing of the leaves is produced, but the causes are completely opposite and the remedies differ. Chlorosis is attributed to an excess of lime, and is corrected by adding iron sulphate to the soil, which it is usual to add to the fertiliser mixture. The Foliocelosis or ' Vinsat ' is generally attributed to a lack of lime, which is added in the form of hydrate or carbonate in acid soils, and in the form of sulphate in those with alkaline reactions (the predominant type in citrus orchards).

This is not the end of the hazards attending the production of a good crop. There remain those due to the environment, above all weather conditions. In order to protect the orchards from winds, which are often strong and even violent, very thick hedges of cypress trees, thuyas or bamboos are planted at the boundaries. These act as protective screens either from cold winds which blow in from the interior or from the warmer winds which are, however, laden with saline substances, blowing off the sea. The same protection is used against very clayey dust from roads and paths.

Heavy rains, prolonged and continuous in spring, when the pollen is ripe prevent pollination from being carried out and ruin the crops. This was experienced in wide areas in the province of Valencia in the spring of last year.

Treatment of ' Gummosis '—the roots and collar of the tree are bared ready for application of permanganate of potash

First signs of ' Gummosis ' on citrus—cracked bark with gum starting to ooze out

Frost damage

Equally there is the most terrible of all enemies of the citrus crops: frost.

Owing to the remunerative nature of this crop it has extended to regions which reach and even exceed the limit of the normal area of cultivation, in the sense that it is rare to have a year in which temperatures below 0° C. are not produced during the winter. To plant citrus crops in these districts is a gamble, and it is logical that there should be many more losers than winners.

But even orchards in the most favourable positions on the coast or in the sheltered valleys are not exempt from this danger. In severe years, when the temperature falls abruptly to 0° C., and when such a cold environment persists for more than an hour, particularly if it is not accompanied by moisture, disaster is certain and irremediable.

Everyone can still remember the catastrophe which was suffered by the province of Castellon in the winter of 1946: a cold wind from the north-east, laden with fine snow, destroyed a large number of plantations, for the trees themselves died and had to be cut down. Those which were not entirely killed had to be cut at the base of the trunk and grafted afresh. That year's crop was lost and those of the two following years. Up to 1951 these orchards had not resumed normal production.

(From the *Overseas Review*, published by Plant Protection, Ltd.)

Turkey, showing principal tobacco-growing areas, factories and research stations

The Tobacco Industry of Turkey

TOBACCO in Turkey is produced in the Aegean, Marmara and Black Sea regions, as well as in the Eastern and South Eastern areas, and consists mainly of cigarette tobacco. However, during the last few years, some progress has also been made in the production of cigar tobacco.

Area cultivated and yearly crop

Figures relating to the cultivation of tobacco in Turkey during the last five years are as follows :—

	Area (Hectares)	*Crop (Tons)*
1947	132,481	101,928
1948	106,099	83,079
1949	127,419	99,364
1950	128,319	84,983
1951	124,111	83,184

Cultivation of tobacco

The method of producing tobacco in Turkey consists of planting the tobacco seeds in nurseries, and transplanting the seedlings to the tobacco fields.

The dates for planting the seed in the nurseries, and transplanting the seedlings, the development of the leaf and the gathering of the crop vary to a certain extent, depending on the climatic conditions and the weather in the various zones of production. For instance, while planting tobacco seed might begin in January in the Aegean region, the same operation might be delayed into late March in the Marmara and Black Sea regions, with the result that the transplanting of the seedlings will go on from the end of March well into June.

The gathering of the leaf starts in July or August, according again to the region and the climate.

Owing to the fact that all the leaves on a plant do not ripen simultaneously, harvesting follows a pattern which allows for the development of each leaf. The first to ripen are the lower leaves, followed by middle leaves, called ' Anas,' while the last to develop are the end or 'Uc ' leaves, which constitute the pick of the crop. This means that the process of harvesting entails five to seven operations.

The leaves gathered each time are strung up and left to dry in the sun.

The following article gives information about the important tobacco industry of Turkey. It was received too late for inclusion in our July number, which was mainly devoted to the subject of tobacco production. We are indebted to the Turkish Embassy and to the Turkiye Tutuncular Birligi of Galata, Istanbul, for the article and for permission to publish it.

Yield and marketing

The production of tobacco in Turkey takes place on slopes and mountain fringes exposed to the sun. Other types of tobacco produced in other countries are grown on the plains and on humid land, with the result that they may yield up to 1,000 to 2,000 kg. per hectare, as against 500 to 700 kg. in Turkey.

After being dried in the sun, the tobacco is baled by the planter for sale in the village, or to the Turkish State Monopoly warehouses in the towns.

Turkey is famed for the excellence of her tobacco. Therefore more importance attaches to the quality of the tobacco rather than to the quantity. This depends on the type of seed planted, the nature of the soil, climatic conditions, the position of the field and on whether the leaves of the individual plants are at the top or are situated at regular intervals on the plant. Other factors to be taken into consideration are the weather conditions during growth and the care bestowed on the crop, the production of fine tobacco being impossible without unwavering care, and considerable knowledge and experience. High grade Turkish tobacco owes its reputation to the fact that production is a tradition carried on by families and that the quality of the tobacco is a point of pride to each.

The climate and soil of Turkey vary considerably from district to district,

and consequently it is possible to produce tobacco to suit all tastes. The following is a very brief description of the chief varieties.

Principal types

Trabzon and Artvin tobaccos are comparatively strong, Bursa tobacco is mild, Tasova neutral, Izmit mild and slightly piquant, Samsun sweet and aromatic, while Aegean tobaccos are mild and sweet and have a characteristic aroma.

The average nicotine content of Turkish tobacco is lower than 1%, while the maximum amount of nicotine is usually lower than the minimum contained in tobaccos produced elsewhere.

Turkish tobacco ranges in colour from light golden to bright reddish yellow. Leaf grown in the Aegean and Samsun regions is small, finely stemmed and of delicate texture. Trabzon leaf, on the other hand, is large and when cut gives a reddish tobacco.

Turkish tobacco partly owes its reputation to its excellent burning quality and its white ash, while the high cigarette yield of most Turkish tobaccos is an additional advantage it possesses from an economic and commercial point of view.

The tobacco is particularly valuable for blending with and balancing other cigarette tobaccos ; this is shown by the fact that the United States, the world's largest producer and exporter of tobacco, has each year increased her imports of Turkish tobacco. The leaf has in fact, through blending, made possible the use of much low quality tobacco by improving the colour and flavour.

Uses of Turkish tobacco

Turkish tobacco has three different uses in the cigarette industry :—

1. In Turkish cigarettes manufactured entirely from Turkish tobaccos.
2. In blends with tobaccos produced in other middle eastern countries with the object of improving the quality.
3. In blends with Virginia tobacco in American and English cigarettes.

Samsun and Bafra tobaccos are the only tobaccos in the world which can, without the addition of any other tobacco, produce a delicious and mild cigarette. Cigarettes to satisfy every taste can be manufactured from the blends composed of Turkish tobaccos of divers origins.

Apart from the fact that they improve the quality of Virginia and Burley tobaccos, Aegean tobaccos in particular are much sought after because they can, without damage to their characteristics, undergo the flavouring operations to which Virginia and Burley tobaccos are subjected.

Typical tobacco country in Turkey; note the drying leaves on the left

Gathering the tobacco leaves

Stringing up the tobacco

On this account they have earned the name ' Turkish tobacco—Universal Type.'

Exports

Turkey's exports of tobacco during the last five years have been as follows :—

	Exports in kgs.
1947	42,292,592
1948	49,167,671
1949	77,624,655
1950	49,236,780
1951	56,191,217

Approximately 20,000,000 kg. are consumed locally, the remainder being exported.

Chief amongst the 20-odd countries which import Turkish tobacco are the United States, Western Germany, France, Egypt, Austria, Czechoslovakia, Belgium, the United Kingdom, Sweden, and Finland, while during 1951, Spain, Soviet Russia and Jugoslavia also purchased appreciable quantities.

The United States' increasing imports of Turkish leaf indicate the importance of Turkish tobacco in the cigarette industry. Thus, during the last few years, exports of Turkish tobacco to the United States have risen from 25,000,000 to 30,000,000 kilos in 1950, while during 1951 they have exceeded even the latter figure.

Aerial Desiccation Experiments

Following our announcement last month that experiments in crop drying, by applying certain chemicals to the plant a week or so before harvesting, were to be carried out (WORLD CROPS, **4**, 8, p. 264) in the south of England, 25 acres of wheat and barley were sprayed from the air with a new chemical solution which, it was hoped, would cause the grain to lose its high moisture content before combine harvesting and thus eliminate further drying processes. An Auster Aiglet aircraft flying at 10 ft. sprayed six different chemicals at various strengths on trial plots varying from 200 to 800 yds. long. The spray was applied at the rate of 10 gal. per acre.

Advantages of the new process if it is successful will be that the harvest can be combined earlier with a low moisture content—it is hoped as low as 14%. It may well, also, solve the problem of sub-epidermal fungus. If the experiments—which have been carried out under the direction of Dr. H. Allen, of the Plant Protection Research Station, Fernhurst, Sussex—are successful, they might also mean that less moisture will be taken up in a wet summer and this would result in less chance of poor crops under such conditions.

Aspects of British Colonial Agricultural Law

Part II — Inspection and Grading of Products

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In establishing export industries in colonial territories a difficulty has been that of ensuring that exported produce shall be of acceptable quality, especially that produced by native exporters. To ensure this many countries have enacted legislation to ensure that satisfactory export standards are maintained by compulsory grading and inspection. This article, the second in Mr. Masefield's series, discusses various aspects of this question.

THE inspection and grading of produce provide a field in which comparisons of colonial legislation are both interesting and instructive. Systems of inspection are of two kinds—inspection at the time of marketing, and inspection at the time of export. The former can again be subdivided into inspection before purchase and inspection after purchase.

Inspection before purchase

Perhaps the most thorough-going system of grading before purchase is applied to groundnuts in the Gambia, in a manner which is without parallel elsewhere. This colony is so dependent upon groundnut exports that the quality of of the produce justifies the most rigorous legislation. The Adulteration of Produce Ordinance, 1924, provides that groundnuts may not be purchased for export unless they have passed through a rotary screen approved by the Director of Agriculture and complying with detailed specifications. The essential part of these specifications is that the iron rods of the barrel are to be $\frac{3}{8}$ in. in diameter and to be spaced 21/32 in. apart centre to centre, thus eliminating husks and all nuts outside a certain size group.

Inspection of cotton before sale has long been compulsory in Nigeria, under regulations originally applied under the Agriculture Ordinance, 1926. These provided that at each appointed cotton market an examiner should grade all seed cotton into one of three grades for American cotton, three for improved Ishan cotton, or grade N.N. (native or mixed seed cotton). In Kenya, inspection of produce before sale has been applied to many locally-grown African foodstuffs, notably maize, under the Marketing of African Produce Ordinance (1936). The grade of all scheduled produce was at first checked by an inspector before sale. But when good standards of quality had been established by this system, a gradual change-over was made to inspection after purchase, under which an ' inspection pass ' is issued to the purchaser before he is permitted to move scheduled produce away from the market.[1]

Inspection after purchase

Inspection after purchase is in other cases limited to a check on occasional parcels of produce rather than inspection of the whole. This is the way in which quality is maintained in the important Uganda cotton crop. Under the Cotton Ordinance (1927) cotton is bought in two grades. There is no compulsory examination before purchase, but during the marketing season the cotton markets are constantly toured by agricultural officers and their staffs, and if any buyer is found to have in his store cotton which is below the grade for which it was bought, he runs the risk of a prosecution.

The inspection and grading of produce at the time of export is also usually in the hands of Agricultural Departments in the colonies, though in the large territory of Nigeria there is a separate Department of Marketing and Exports which handles this work.

The statistical aspect

The basic problem of this form of inspection is essentially a statistical one. The most common method of inspection is to withdraw one sample for examination

from each bag, bale, or (for liquid produce) drum of the consignment. This is open to grave statistical objections. It has been shown, for example, with coffee in Uganda, that the variation in quality within bags is greater than the variation between bags. Systems under which one sample is taken from each bag, and that bag rejected if the sample falls below standard, therefore do little to sort out good from bad produce. But there are also weighty reasons for the continuance of this form of inspection. The statistical ideal would be to sample all produce in bulk before it was bagged; but this is not possible where, as in a coffee-curing works, produce is being delivered continuously from factory machinery and cannot be stored unbagged between the times of the inspector's visits. Again, if the produce is bagged it would be statistically sounder to take samples at random, sometimes several from one bag and sometimes leaving bags unsampled, and finally to pass or reject the whole consignment. But this does not deal with the practice of unscrupulous exporters (by no means unknown to inspectors) who will slip in a bag or two of undergrade produce if they know that every bag is not sampled.

Legal repercussions

Only in a few territories does the law seem to have realised the statistical implications of this method of sampling. In British Guiana an amendment of 1932 to the Rice (Export Grading) Ordinance (1930) made compulsory the blending or mixing of rice in a consignment so that the contents of each container are uniform. This ordinance has been repealed since another was passed making the Rice Marketing Board the sole exporter. In Zanzibar the Clove Grading and Export Rules, 1934, provide that a consignment shall not be passed as of any grade if any bale or package in it falls below that grade. The new statistical technique of sequential analysis, which would appear to have possible applications in produce grading, does not seem to have been used anywhere for this purpose, though it is applied in Ceylon to the inspection of rice seed for purity.[2]

Inspection in practice

The ordinary method for inspecting bagged produce is, then, to take one sample per bag; and some of the legislation concerned makes this obligatory on the inspector, for example, the Produce Export (Bukoba Coffee) Rules, 1935, of Tanganyika. For ginger in Sierra Leone, rules under the Native Produce Ordinance (1928) require the inspector to empty out each bag and examine the contents. In other cases he is permitted to sample a proportion only of the bags; in the Gold Coast not less than one-twelfth of the bags of copra under the Coconut Industry Regulations (1934), not less than 25% of the bags of coffee under the Fruit Industry (Coffee) Regulations, 1948, and not less than 20% of the bags of palm kernels under the Fruit Industry (Palm-kernels) Regulations, 1948. In the case of drums of liquid produce an attempt is often made in the regulations to overcome variation within containers due to sedimentation. The relevant legislation in both Nigeria and Sierra Leone requires that containers of palm-oil shall be sampled at three different levels by a standard try-rod.

Bulk sampling

The sampling of produce in bulk remains, however, the ideal method statistically. It therefore tends to be applied by legislation wherever it is practicable, *i.e.* where the produce is not being continuously delivered from factory machinery but is available in reasonably small parcels at a time at the premises where it is to be inspected. Another kind of difficulty, however, arises with this method. If the inspector samples the produce in bulk, he must remain present while it is bagged in order to assure himself that the bags which he is required to seal actually contain the produce he has inspected. For this reason legislation prescribing this form of inspection usually includes a clause requiring that the produce shall be bagged immediately upon completion of inspection.

Legal prescription of sampling

Since in this case the bags or containers do not provide a unit for sampling, the law has to prescribe the method of sampling in much greater detail. This is well illustrated in the case of cocoa, one of the chief forms of produce to which sampling in bulk is applied. The Cocoa Industry Regulations, 1950, of the Gold Coast allow two alternative methods of sampling:

(*a*) by taking from the lot an average sample from which shall be drawn a final sample of not less than 12 oz. for each ton of cocoa or (*b*) by taking at random samples from beans entering the hopper or unclosed bags and drawing a similar final sample. The Nigerian regulations for cocoa inspection prescribe that the cocoa is to be spread out on a tarpaulin for sampling the parcel.

Definition of grades

When the method of sampling has been settled, the other main problem in produce inspection is the definition of grade. Legal definitions in the colonies are of many different kinds. The simplest requirement is that produce intended for human consumption must be passed as fit for such consumption and likely to arrive at its destination in sound condition. This is exemplified for scheduled kinds of produce in the Agricultural Produce Ordinance, 1935, of Malta and the Produce Export Ordinance, 1937, of the Seychelles. In Dominica, under the Sale of Produce (Amendment) Ordinance, 1943, vanilla must merely be certified by a vanilla examiner as 'fit for export.' Sometimes the law takes exception to a particular practice, as in the Claying of Cocoa Ordinance (1923) of Trinidad and Tobago, which makes it an offence to clay cocoa.

For soft fruits, definitions must necessarily be in rather vague terms. A typical set of definitions is provided by the Agricultural Produce Exportation Rules, 1942, of Dominica. These define three grades as follows:

'Choice' fruits are first-class fruits of similar varietal characteristics, particularly as regards colour and shape; firm and free from all discoloration and insect or fungus damage.

'Standard' fruits conform to the general requirements but are not up to the specification of 'choice.'

'Third grade' fruits do not conform to the requirements of 'choice' and 'standard,' but are free from decay and fresh cuts.

In the case of hard produce, such as grains, oilseeds, coffee and cocoa the definitions of grade are usually much more quantitative. They may prescribe for each grade permissible limits of moisture content, extraneous matter, and percentage of defectives, with general provisions as to appearance, odour, etc. The grades for this class of produce are most usually known by numbers, but a grade also very commonly used is 'F.A.Q.'—the letters standing for 'fair average quality.' This does not, however, denote any common standard, for 'F.A.Q.' has different legal definitions in different colonies for the same kind of produce. For example, F.A.Q. coffee from the Gold Coast must be free from extraneous matter and may contain from 20 to 25% of defective beans, while F.A.Q. (Robusta) coffee from Uganda may contain up to 0.05% extraneous matter but must not have more than 10% defectives. It seems a pity that there cannot be more standardisation of grades between British colonies, especially where the produce is sold upon the same market.

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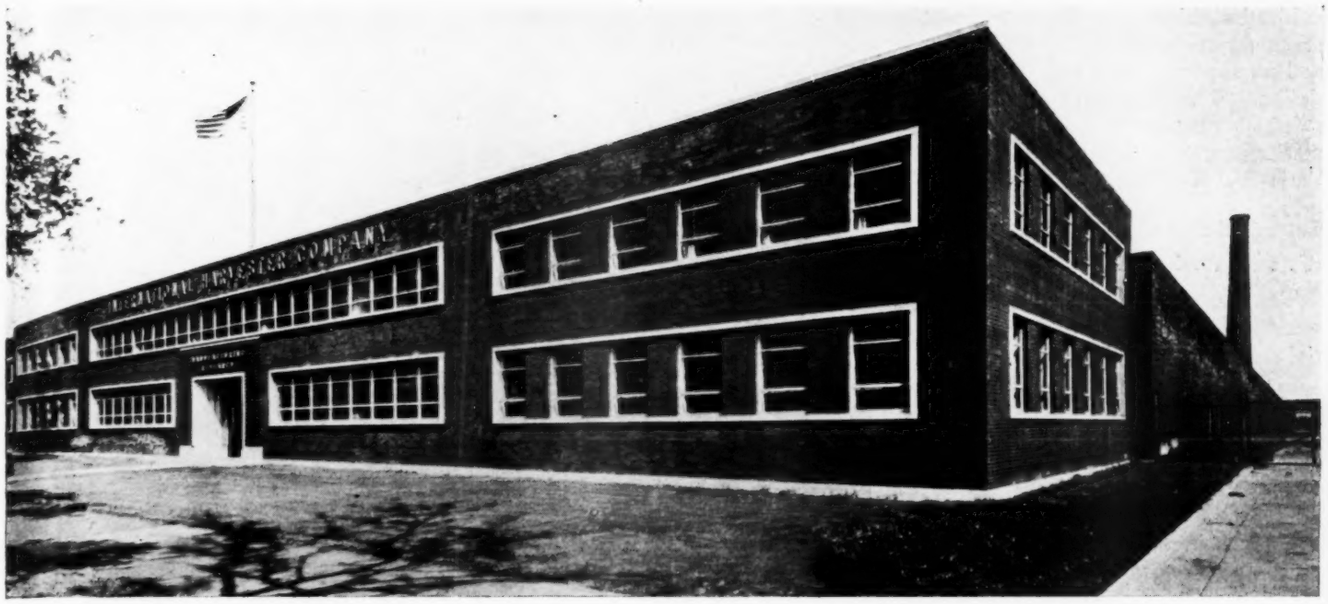


The IH Manufacturing Research Department covers approximately 250,000 sq. ft. of floor space

INDUSTRY'S CONTRIBUTION TO AGRICULTURAL RESEARCH—IX

The International Harvester Company

H. NORRIS

This month's article in this series deals with the work of the International Harvester Company and describes inter alia the manner in which two recently developed machines came into being.

THE growth of the International Harvester Company has been characterised by leadership in new and improved products. Advancements in the design of farm machinery and tractors are the responsibility of our engineers, and their work may fairly be regarded as agricultural research. The intention of the manufacturer is to make a saleable and competitive product, but the engineers who design it must provide equipment which will enable work to be done more cheaply, more efficiently or more quickly—factors which often decide whether the results of crop research can be put into effect at all.

The birth of farm mechanisation

It is now ancient history how Cyrus Hall McCormick perfected his reaper and how, by perseverance and constant effort, the world eventually came to acclaim a succession of improved machines, culminating in a twine binder which differs little from the machine we know today. It is less generally appreciated that this machine is considered to have made possible the development of the American Middle West, and to have helped to assure the triumph of the Yankees over the South, thus exercising a far-reaching influence on the course of developments in the second half of the 19th century. In the 20th century machinery in general, and particularly the tractor, have made possible greater crop yields with fewer hands, a process which probably has been most markedly seen in Great Britain during the two great wars.

At the close of the 19th century, two names dominated the harvesting machinery world—McCormick and Deering. In 1902 these two firms joined forces with other leading manufacturers and formed the International Harvester Company. Soon the new company was engaged in the design and manufacture of tractors and, although many others were similarly occupied, IH gained a leading position before World War I. At this stage the tractor was used almost entirely for simple towing, or belt operations, but by 1918 the company was engaged in a vast experimental enterprise to widen the scope of tractor work and to design equipment to operate behind, in front of, or mounted on the tractor.

The general purpose tractor

The original intention was to have a motor-cultivator unit as the basis, and more than one size was produced in prototype form. Pictures which still exist show a variety of tractor equipment at work, including a mounted buckrake, a mounted power-driven mower, a mounted binder, and cultivator and many others. How far these experiments were ahead of their time will be appreciated when we remember how very recent the widespread adoption of some of these principles is. Another picture shows what we would call a mid-mounted plough with one wheel of the motor-cultivator in the furrow—probably the first use of this principle.

But these machines were ahead of their time and at that date farmers were reluctant to buy a tractor at all and even less inclined to purchase an entirely new set of equipment to use with it. The eventual and practical outcome of this research was the Farmall tractor, produced in 1923. This was more moderately conceived but still revolutionary in principle since it was the first power-driven machine for row-crop

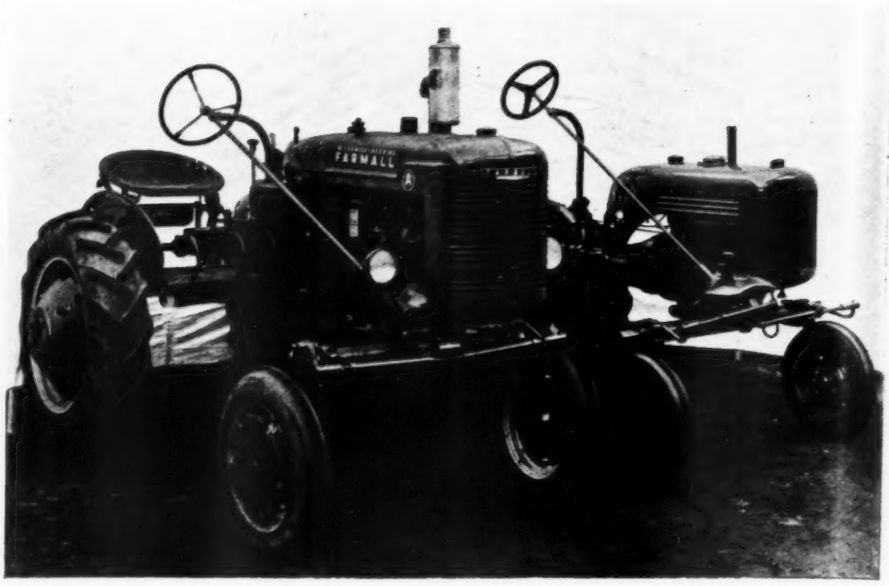
cultivation. The new-style tractor brought about major changes in farming methods and subsequent tractor and farm machine design. The development of row-crop axles, power take-off and power-driven machines was an important landmark in the story of mechanisation.

International character of the developments

Throughout the history of the company one factor has been largely responsible for the successful development of its products, *viz.*, the international character of the organisation. Today, International Harvester has 19 subsidiary companies outside the U.S.A., which maintain 11 manufacturing plants and 63 branch houses. In addition, there are 170 distributors with 112 branches throughout the world. In all, IH is represented in 128 countries, and these units contribute, and have contributed, to a vast fund of practical experience. It is no exaggeration to say that scarcely a crop is cultivated on the face of the globe which has not been studied by Harvester specialists in regard to the mechanical possibilities of land preparation, seeding, cultivation and harvesting.

Engineering work

No aspect of industry has grown more in importance or stature during the last few decades than engineering. International Harvester has in its employ today approximately 1,500 graduates of engineering colleges or universities and approximately 5,000 employees working in engineering operations. Many of these are in offices,



The Baby Farmall beside a Farmall A in December 1943—that is, at a very early stage. At the time it was not even named the 'Cub'

shops and other non-technical positions, but others perform vital tasks in the field we are now considering. There are three main classes and it is interesting to consider their main functions.

Firstly, we have the Advanced Engineering group, members of which must be men with vision and ideas. Often they must think as much as five years ahead, since they are in a large measure responsible for the company's future status. Study, research and analysis of technical and agricultural problems help advanced engineers to meet the farmer's operating requirements and, indeed, often to anticipate them.

Secondly, we have the Product Engineering group, which brings together the ideas of the Advanced Engineering group and the everyday considerations of manufacturing. These men work with the manufacturing divisions in designing and adapting products for manufacture. Apart from this, they must also determine how best Advanced Engineering ideas can be carried out in the production shop, and this involves a vast amount of detail since work of this type enables manufacturing difficulties to be avoided before they arise. These men carefully follow a product's course through the stages of pre-production design, models and tests until it is ready for full-scale production—and thereafter continue to observe its further behaviour in the field.

Thirdly, there is the Experimental and Test group. These men work with both the Advanced and Product Engineering groups. New products are first engineer tested, on proving grounds and in laboratories—and then subsequently tested by farmers under widely varying conditions. Thousands of hours of closely supervised tests are made by members of the experimental and test groups. The results of these tests are used by other engineering groups in further development of a product, and it is not until performance and quality requirements are fully satisfied that a product is introduced to the customer.

Super power plant frame with two-furrow plough mounted so that right ground wheel runs in the furrow. Note the adaptation of the track-laying principle in the rear drive. This was one of the experimental machines demonstrated in 1918 but never put into production

Organised curiosity

There is one group of research workers in agricultural engineering who do not, on

first consideration, appear to have much to do with the design of machines—the Manufacturing Research men. Their function is to study existing and new manufacturing processes, methods and equipment. Prior to 1947 such problems were studied by IH on a decentralised basis, that is, wherever manufacturing was carried on. In that year, however, International Harvester established a $4,500,000 Manufacturing Research Centre in Chicago to co-ordinate the company's research programme in technical manufacturing activities of all kinds.

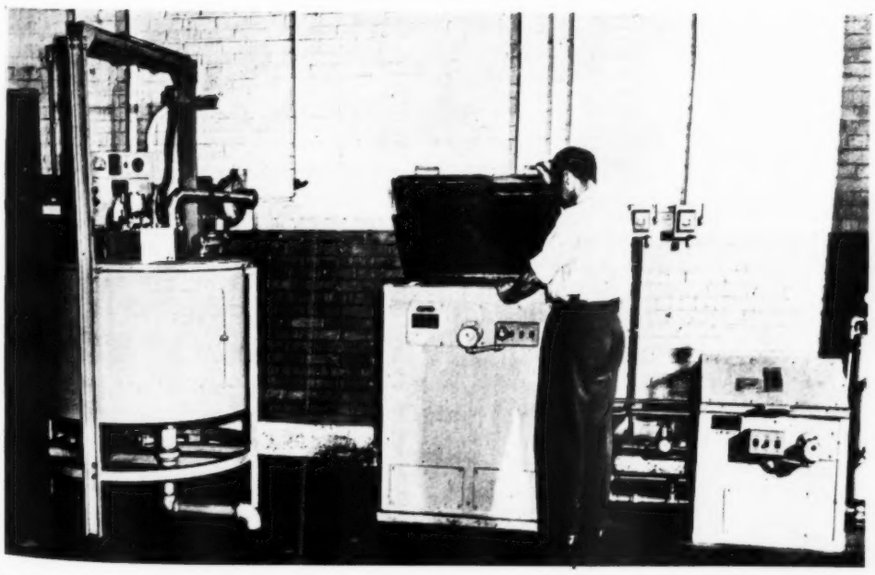
The building which houses this operation resembles in nearly every respect a complete manufacturing works, but with the important difference that no production line of merchandise flows out of the plant. The 300 men who work there deal in ideas, their aim being to improve working methods and conditions, to reduce manufacturing costs and to lengthen the working life of the product. Problems are directed to these workers from many sources ; firstly, of course, from the manufacturing plants themselves, including works in the overseas group such as England, Australia or France. Many requests also come from sales departments, product engineers or even from technical societies and other industrial groups.

The manufacturing equipment is of the most modern type, but it does not handle runs of thousands. For example, a $1,000,000 foundry produces small runs of experimental castings which are subjected to severe tests in other parts of the plant. The highly specialised test equipment includes a million-volt X-ray installation, electron microscopes, a wide range of fatigue testing machines, a butt-welding machine which uses enough current to light 27,000 40-watt bulbs, and an X-ray diffraction instrument.

Test rigs and equipment enable individual parts to be subjected to the equivalent of a lifetime of abuse in a matter of hours, or to undergo the equivalent of a year's exposure to the weather and to humid or salt-air conditions in a few weeks.

All this work is additional to investigations carried on in individual manufacturing plants and in the various engineering departments. Although the results of such research mainly concern completed designs already in production, the principles and techniques to which they give rise necessarily also affect the future trends of design and planning.

Research test team in the field with diesel-powered cotton picker



Exposure testing in the Manufacturing Research Department. (*From left to right*) **These pieces of apparatus (1) develop tropical heat and rain in alternating cycles, (2) throw salt water spray on parts undergoing that test, and (3) develop a climate of 100% humidity**

Picking cotton

Perhaps the most Herculean task ever undertaken by agricultural machinery research men was that of the mechanical harvesting of cotton. One almost insuperable difficulty was that all the bolls do not ripen at once, so that the machine to be devised must not only pick the fluffy seed cotton from ripened bolls without loss, but must leave the plant itself and the ' green ' bolls unharmed. It would not have been surprising if research had been abandoned at an early stage. Yet, after 25 years of research and field test, in 1941 International Harvester announced that its mechanical cotton picker had been perfected. Once again the Farmall tractor was the basis of the unit, but this time it was driven in reverse with a monster meshed basket mounted over the engine.

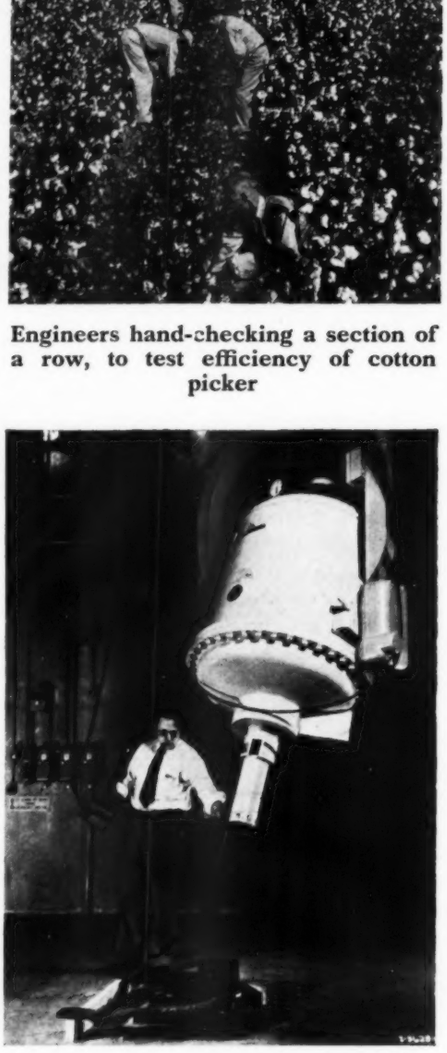
In sequence, the McCormick International picker 1, guides the stalks to a drum, where 600 barbed spindles, revolving at 2,000 r.p.m., pick the ripened bolls, leaving the green bolls unharmed ; 2, frees the cotton from the spindles with rubber doffers and 3, blows the cotton up onto cleaning grates and drops it into the basket. In design, manufacture and operation, this picker has been termed ' the most ingenious piece of machinery ' in all agriculture. In big fields of mile-long rows, the mechanical picker outpicks a man by 25-30 times, and reduces harvesting costs by over 40%.

A layman might think that the successful launching of the picker wrote ' finis ' to the efforts of the research teams involved. But last season saw C. R. Hagen, veteran experimental engineer, still in the field with

other research men and spending his 26th year ' squinting at bolls '. This field group included advanced, product and experimental engineers, and apart from studying possible improvements to the current machine, they were conducting field tests with a two-row model which should further increase the output. At the Manufacturing Research Centre in Chicago other teams were grappling with a big programme aimed at achieving substantial cost reductions on the manufacturing side.

Even at this stage, efficiency tests are most rigorous and one of these is manual checking of a section of a row. To do this, a section with 300 ripened bolls is counted off ; unpickable cotton is removed and the ground below is cleaned. Then the picker passes through the test area. The remaining bolls are counted (each boll has 4 or 5 locks, 38-49 seeds), so, by projecting the number of seeds in the unpicked locks, the boll count ' miss ' is reached. In California, the picker's efficiency is over 93%. Other tests are used to get additional data on the grade of the cotton lint.

Engineers hand-checking a section of a row, to test efficiency of cotton picker



This 1,000,000-volt X-ray machine is operated from a control room shielded by concrete walls and lead-lined door. The resulting X-ray film can accurately detect flaws through 5 in. of solid steel

Farmall Cub tractor

The cotton picker is a one-job machine, and its use is limited to big operations in a specialised field of agriculture. At the other end of the scale, however, there is the Farmall Cub, the first tractor designed for the smaller farmer who had hitherto managed with from two to four horses.

The Farmall Cub was started with a production of two units in September 1943, prior to any definite factory pre-production programme, and was designed to bring commercially profitable farm tractor power to farms with appreciably less than 40 acres under crops. Previously, the smallest tractor produced by the Company had been the Farmall A and the new model was designed to be approximately two-thirds of the weight and power of its elder brother, that is, weighing only 1,050 lb. and having only 10 h.p., or approximately 8 h.p. at the drawbar.

From the very first it was the intention that the Cub would be built with the same standards of materials and workmanship as the company's larger tractors, while the torque characteristics of the engine would conform also. It was not possible to incorporate in the design many of the actual components used in the larger tractors, and the little tractor was thus an entirely new creation, though similar in appearance to the Farmall A. One important factor at the commencement of the work was the ultimate selling price, but as work progressed it became evident that quality could not be sacrificed for price. There were certain quality features of the Farmall line for which no satisfactory substitute could be found, so that the style of the Cub drew ever closer to that of the Farmall A.

The first two units were field-tested in the autumn of 1943 and early in 1944 ; then a pre-production programme was set up by which a further 20 were made and put into use in autumn 1944. The rigorous testing to which they were submitted brought about changes and improvements in design, and all models were returned to works, so that these could be incorporated. Further models went into the field in 1945 and 1946 and actual production began in the Louisville Works in May 1947.

Superficially, the problem may not seem considerable ; a company which has been in tractor production for 40 years decides to make a new model on lines similar to one of the many popular tractors already in production. It has to weigh less, and cost less and, therefore, will have less power. Considerable time was spent in exploring the potential market to decide the size of tractor wanted and the price at which it would sell. Thereafter the engineers got down to design and eventually two units were put into the field. From then, it took three and a half years to get into normal production, most of which was spent in testing and modifying the product.

No doubt this time was profitably spent, for the Farmall Cub was a success from the first, having adequate power for the purpose for which it was designed, possessing outstanding fuel economy and, with its line of appropriate scaled-down implements, proving a boon to a new class of tractor user, including part-time farmers and market gardeners.

An interesting side-light is that originally a power lift was not planned for the tractor. However, it soon became evident that the users wanted convenience and complete ease of operation in appliances, so that a power-lift was made available soon after the Cub went into production.

The Cub might possibly be described as ' just another tractor,' but it was no easy task to scale down a successful model, together with a wide range of implements, retain all its general purpose features and yet produce it at a price that makes it an investment for the part-time and the 10-acre farmer.

The research that went into this product has been a boon for the ' little men ' who numerically are so strong, whose production is so important, but whose labour is so seldom regarded by the bigger manufacturers of farm equipment.

Nearer home

Although there is an International Harvester works in Doncaster, England, this article has dealt almost exclusively with activities outside these islands. In part this has been done to suit the overseas readership of WORLD CROPS and to strike a somewhat different note from the other articles which have appeared in this series and which deal mainly with research in Great Britain. However, it would not be fitting to close without reference to International Harvester's establishment at Doncaster.

The International Harvester Company of Great Britain, Ltd., was formed in 1907 and, before that, the products of the McCormick companies were known here since 1851, when Cyrus Hall McCormick had his first great international success at the Great Exhibition. Until 1946 IH of Great Britain functioned solely as a sales and servicing unit for imported machines, but in that year long delayed plans for manufacturing were put into motion. Today the Doncaster Works is producing the Farmall BM Tractor with a drawbar horse-power of 32.86, pickup baler, power-drive mower, green crop loader, ploughs, disc harrow, toolbars, manure spreader and bale loader.

Engineering research work has already been carried out in England of the types already described, *i.e.* advanced, product and experimental, but the main activities in this direction have been concerned with machines which have not yet been announced as part of the production programme. In these circumstances it would not be expedient to attempt here to discuss work of this character. The machines and the tractors in production in England are tried and established favourites, and engineering investigation has been mainly concerned with routine checks of the domestic prototypes and pre-production machines. This work is important to the user but it would be stretching the limits of the subject too far to describe it here.

It can be said, however, that IH engineers in Great Britain are working on many projects to bring new and improved products to British and overseas farmers. The value of these efforts is enhanced by the fact that similar work is in progress in many other parts of the IH organisation and that the knowledge and ingenuity of the staff in England is correlated to knowledge and skills garnered from many other parts of the world.

Machinery Consultant for India/Pakistan

The appointment is announced of Major D. T. Brown as Agricultural Engineering Consultant and Representative in India and Pakistan for four firms of agricultural machinery manufacturers, Messrs. Salopian Engineers Ltd., E. V. Twose Ltd., John Wilder Ltd., and Kenneth Hudson and Son.

Major Brown was until recently Agricultural Engineering Advisor to the Government of India. Before the war he acted as Agricultural Engineering Advisor in the U.S.S.R. to the Soviet Government and prior to this was one of the founder members at Oxford of what is now the National Institute of Agricultural Engineering.

The effect of an infestation of red spider is well illustrated in the left-hand picture taken in late summer and showing Cox's Orange Pippin trees sprayed with DDT, which destroyed the predators, and no efficient acaricide. The right-hand picture shows a neighbouring orchard which was correctly sprayed

A New Summer Ovicide for Red Spider

G. A. EMERY
The Murphy Chemical Co. Ltd.

The control of Red Spider, particularly on fruit trees and as a pest in greenhouses, has emerged as one of the major crop protection problems of recent years. Consequently, the appearance of the new and highly promising mode of treatment described below is an event of some importance.

DURING the past quarter of a century red spider has gradually advanced from the position of a minor pest to that of the most important pest of many fruit and other crops. This increase is correlated with the increasing use of more efficient insecticides that have reduced the population of predators which formerly kept red spider in check. Unfortunately, the development of acaricides has lagged behind that of insecticides. Dormant petroleum oils are moderately effective in destroying winter eggs on apples and plums, but never give 100% control. If bad weather conditions follow the application, bud damage is liable to ensue, while on occasions bad weather may prevent application altogether.

Earlier attempts at control

Summer white oils and derris preparations were used for many years, but results were not always satisfactory. Where lime sulphur is used for scab control, careful timing of application can do much to keep the mites in check, but many crops will not tolerate lime sulphur.

Azobenzene at first showed promise, but results have been variable and where an oil, or even an insecticide in miscible form, has been applied shortly before or after the azobenzene, severe damage has resulted. This once promising ovicide is now only used to any extent in glasshouses, either in the form of smoke generators or as a solution for atomising. In many cases red spider has developed marked resistance to azobenzene.

More recent efforts

During the past few years active research into the problem of red spider control has taken place, particularly in the U.S.A. and England, and many compounds have been tested. The work done by Schrader in Germany on phosphorus compounds before

and during the war brought first HETP and then parathion into the field. The former is not very satisfactory, because of its very transient action and absence of effect on eggs, but parathion has given very good results. There are, however, drawbacks to its use. Parathion is extremely toxic, and special precautions have to be taken, particularly when it is applied by unskilled labour. Moreover, it destroys beneficial insects equally with the pests. Although races of red spider have developed resistance to parathion, it has, in general, given efficient and economic control.

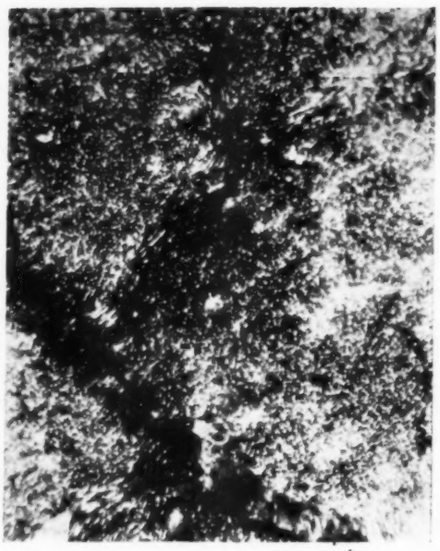
The most recently developed phosphorus insecticides, the systemics schradan and bisdimethylamino-fluorophosphine oxide, give a high kill with prolonged residual action. They do not seriously reduce the population of beneficial insects, but, in common with the other phosphorus insecticides, they have the objection of high mammalian toxicity and are therefore not always acceptable.

Great interest has therefore been shown in the search for efficient non-toxic acaricides and a wide range of compounds has been investigated, of which very few have shown real promise. Of those which have passed into commercial practice in the U.S.A., di-(parachlorphenyl)methyl carbinol (' Dimite '), parachlorphenyl-parachlorbenzene sulphonate (' Ovotran ') and paradichlorphenyl phenyl sulphone (' Sulphenone ') may be quoted. American literature contains many references to work with such compounds.

Although compounds may be found which are highly toxic to the adult or to the egg of red spider and still possess low mammalian toxicity, most of them are ruled out because of one disadvantage or another—they may be too expensive to manufacture, too fleeting in action, or phytotoxic.

Difficulties

Unfortunately, it appears to be the case with mites that the fewer individuals there are on a leaf, the more prolific they become. Nothing less than about 98% control is therefore of real practical value. Furthermore, there is a complete overlapping of generations, all stages from egg to adult being present during the summer. This means that for effective control a material must either destroy all stages or else have sufficient residual action to ensure that its effect lasts longer than the egg stage, if it only kills adults, or longer than the adult stage if it is an ovicide. A combination of two materials to kill both stages is obviously possible, and mixtures of derris and white oil have been used for this purpose, though they involve extra cost.



(*Top*) **Photo-micrograph showing eggs of glasshouse red spider treated 14 days previously with Murvesco and completely destroyed.** (*Bottom*) **Untreated eggs of the same pest showing normal translucence. (Photos x 35)**

Recent developments

In England a number of compounds, have been investigated at East Malling[1,2] and work on similar lines has also been carried out by the Murphy Chemical Co. Two materials initially showed promise and were given extended trials. These were DPS (diphenyl sulphone) and PCPBS (parachlorphenyl benzene sulphonate).

DPS was selected for investigation because it gave a moderate kill of both egg and adult stages, but full-scale trials showed that the degree of kill of neither stage is sufficient for commercial control. The compound also proved phytotoxic in many instances.

PCPBS, which chemically is very similar to Ovotran, has, however, given extremely good results, both in orchard trials and under glass, and has fully borne out the promise shown in preliminary trials. Kirby and McKinlay[1] showed that PCPBS applied on one side of a leaf affected eggs on the opposite surface; this effect was corroborated by Read and Smith[3] in the case of the greenhouse red spider.

Results of field trials carried out in 1951 have been reported by Hey[4] and by Cakebread[5], while the results of the present season's work will form the subject of a paper by Hey at the forthcoming Third International Congress of Crop Protection.

PCPBS is an ovicide, effective against summer eggs of mites only. It does not kill adults or winter eggs; neither does it appear to have any action on insects or insect eggs. It has a residual effect which persists for perhaps 14 days. It is apparently effective against eggs laid before or after the spray has been applied.

Formulations

Investigations into formulations and rates of use have shown that a wettable powder is more efficient than a miscible preparation, and that 0.05% PCPBS is the maximum concentration required. Under hot, dry conditions 0.025% seems to be fully effective. The reason for the superiority of the wettable formulation has not yet been elucidated, but may be due to reduced loss by volatalisation. At present both 20% and 50% wettable powders are in use.

Timing of applications

Correct timing of the spray is essential to gain most advantage from the material. The first application should be made when the majority of adults hatching from winter eggs have completed laying the first batch of summer eggs and before these have hatched. A second application, 10 to 14 days later, has practically eliminated red spider from many orchards.

The present investigations have brought to light the fact that knowledge of the life cycle of the fruit tree red spider is far from complete. Winter eggs have been observed to hatch over a period of nearly two months, while the first summer eggs have had an incubation period of as long as 28 days. Where winter eggs are hatching over an unduly prolonged period, obviously a third or even a fourth application of PCPBS may be required.

If it is essential to destroy the adults present, because their number might lead to premature bronzing of the leaves, a liquid derris preparation may be added to the PCPBS. Where the infestation is mainly in the form of summer eggs, such addition should not be necessary.

So far, PCPBS has been tried out on many varieties of apple, pear and plum, and no phytotoxic effects have been observed except on one or two varieties of apple. In the case of Worcester Pearmain and James Grieve, in some orchards PCPBS appears to have accentuated the shedding of fruit at the normal 'June drop.' This phenomenon is associated with withering of the two basal leaves of the fruit spur and longitudinal cracking of the peduncle. On the variety Worcester Pearmain, in some orchards it also appears to have caused cracking of the fruit; this seems to be aassociated with high temperatures and dry conditions. It has also been applied to a wide variety of other crops; the only ones to show damage have been *Cucurbitae*.

Compatability and toxicity

PCPBS is compatible with most other insecticides and fungicides, although there may be some doubt about its use with Bordeaux mixture. There is no adverse effect on spray machinery or hoses, and no skin irritation to workers.

In an investigation of mammalian toxicity, 500 mg. per kilogramme bodyweight were fed to rats for a period of four days, without any observable adverse effect. The material may therefore be regarded as non-toxic.[6]

Under glass, PCPBS can be effectively used in the form of a solution in a volatile solvent, for atomising with a compressed air, paint spray gun or other form of aerosol generator. Experiments with smoke generators are still in progress.

Further possibilities

A combination of this ovicide with DDT may make it possible safely to use the latter for the early summer control of codlin moth and the new apple tortrix, *Adoxophyes orana*, without risk of causing a disastrous build-up of red spider. This aspect is being investigated.

Most of the research has so far been concentrated on the fruit tree red spider (*Metatetranychus ulmi*, *Paratetranychus pilosus*) and the greenhouse red spider (*Tetranychus telarius*), but preliminary experiments indicate that PCPBS should also be suitable for the control of other species of mite, such as the citrus mites.

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RESEARCH DEVELOPMENTS

Two New Insecticides

THE Julius Hyman Co. have again found two more new insecticides. It was this firm against whom the Velsicol Corporation obtained an injunction forbidding the sale of 'Chlordane' under the name of 'Okta-Chlor': Hyman himself synthesised chlordane, and these new materials, successors to the Hyman compounds Aldrin and Dieldrin, are direct descendants of chlordane.

The latest materials styled provisionally Compound 711 and Compound 269 are closely related chemically to Aldrin and Dieldrin. They resemble the earlier compounds in much the same way that gamma BHC is like its fellow isomers. Aldrin has the same chemical formula as 711, the two differ only in the small but important matter of molecular shape. The same is true of 269, which has the same composition as, but a differently shaped molecule than, Dieldrin. These new pesticides have properties similar to their 'twins'; thus both Aldrin and Compound 711 are quick-acting and no claims for great residual efficiency are made. Compound 269, like Dieldrin, however, has a long lasting effect comparable with that of DDT.

Applicability

Hyman entomologists provisionally envisage 711 and 269 as being of great value against caterpillars and the sucking insects such as aphids and cotton stainers. Indeed, the technical release suggests that 'small doses of 711 and incredibly small doses of 269' will be effective against these pests. Although few field trials are reported the Hyman Company do not appear to have overcalled their hand, for exceptionally promising lab. data are available.

As now reported 711 is more toxic than DDT against southern armyworm (×6), pea aphid (×3) and houseflies (×3½) while it is equal or superior to gamma BHC against German Cockroach (DDT is ineffective against this pest), armyworm (×4) and pea aphid (×3). Against the same species and compared with the same pesticides, 269 is more potent than DDT against armyworm (×33), pea aphid (×13) and houseflies (×4½) and superior to gamma isomer against armyworm (×25) and pea aphid (×13). Against German Cockroach it is only one-third as active as gamma BHC.

It is presumed, but nowhere stated, these laboratory tests were carried out under identical conditions, because unless the insecticides are formulated and applied in identical fashion valid comparisons cannot be made. The published tests give no data on comparative speeds of action, residual efficiency in field or laboratory or how the materials will react to 'weathering,' either naturally in the field or artificially in the laboratory.

Compatability

Chemical tests show 269 and 711 are alkali-acid stable under the usual conditions of use, so these pesticides will be compatible with fungicides when used in mixed washes. These new insect poisons are readily soluble in the common organic solvents (xylene, benzene, acetone and paraffin type oils) so that cream-type emulsions and self-emulsifying preparations may not be difficult to formulate or to dilute. If the general 'stickness' of their technical grade relatives is any guide, dusts of 269 or 711 may be difficult to prepare, and may present problems in storage, especially under tropical conditions.

Mammalian toxicity

Tests on rats show that 269 and 711 are fairly toxic, a lethal dose being of the order 10-17 mg./kg. body weight: work at present is proceeding to determine various other aspects of this toxicity: for example, the effect of long-term feeding, rates of accumulations and the deposits of these poisons which can be tolerated on human foodstuffs. The high toxicity value may not preclude commercial exploitation of either material, thus, for example, against codlin moth 1/20-1/25 lb. of 269 per 100 gal. of wash might be expected to be as effctive as ½ lb. of DDT/100 gal. Limited field trials on cotton pests in America showed ⅕ lb. of 269 to be as effective as ½ lb. of DDT per acre against many species of caterpillar. Because of low application rates residual deposits and risks will be correspondingly smaller.

Costs per 100 gal. of wash are not published, but the very low rates of usage may offset any serious price advantage DDT or gamma BHC may possess; at the moment, it does not seem that either material will affect the sales of gamma BHC preparations although chlordane, toxaphene and nicotine may encounter considerable competition from these newcomers.

ALAN GOODMAN

NEW BOOKS

Untaken Harvest

By George Ordish. Pp. xii + 170. Constable and Co., London, 1952. 15s.

This book, as some people might be inclined to think from the intriguing title, is not a work of fiction but a careful and very informed critical study of the depredations of insect pests, diseases and weeds on cultivated crops. It is written by Mr. George Ordish, who is Agricultural Economist to the well-known firm of Plant Protection Ltd. The book comprises some seven chapters, while there is a short foreword by Viscount Bledisloe, so well known as an administrator, an authority on all aspects of agriculture and President of the memorable Second International Crop Protection Congress held in London in 1949.

The first two chapters are concerned with the general aspects of pests and diseases and the losses they cause. In this connection the author has adopted an interesting concept in expressing the losses sustained in certain cases by the equivalent crop area which may be regarded as lost as the result of attacks from pests and diseases; this is, of course, the untaken harvest referred to in the title. In regard to the U.S.A., for example, basing himself on Hyslop's 1939 survey of the position for the United States Department of Agriculture, he shows that the loss of land was equivalent to approximately 30 million acres, while the monetary loss was estimated at 1,602 million dollars *after* 161 million dollars had been spent on control measures, and these estimates are probably on the low side. In the United Kingdom the equivalent figures are put at close on 2 million acres and £88 million, including cost of control measures. In less developed countries where control measures are not so widely practised losses are considerably more extensive. Thus, in South America losses of food crops may amount to as much as 50% of the entire crop.

This is an appalling conclusion. Discussing the economic aspects of the question in chapter 3 the author considers the reasons why the crop protective measures available are not employed more extensively; one of them, he concludes, is the fear that complete control might result in such large increases of crop that gluts and decreased returns to the grower might ensue. He emphasises, however, that the real remedy for a surplus of any crop is not to encourage more pests to keep the surplus down but the avoidance of surpluses by regulation of planted area and the ordered disposal of crops in areas where supply is short, combined with adequate application of the science of plant protection towards combating pests and disease. He illustrates this by reference to the plum crop in England, where winter tar oil washes have ensured perfect control of the plum aphid, formerly the principal controlling factor to the size of the crop. This has meant that the plum crop is much more regular each year and sales can be better controlled because their size can be anticipated with considerably greater accuracy.

The remainder of the book is concerned with various methods of combating pests and disease and there is an excellent general condensed discussion of the methods available including the use of aircraft. The social effects of the incidence of pests and diseases are discussed, the present and probable future trends of plant protection, emphasising the need for more and better statistics regarding losses from this cause, while the last chapter deals briefly with the history of the trade in insecticides.

In concluding this review we accord a warm welcome to this thoughtful book, which, despite its relatively small size, puts into perspective many urgent problems of today. The author quotes F. H. Knight as saying in 1921: 'We live only by knowing something about the future; while the problems of life, or of conduct, at least arise from the fact that we know so little.' So far as pests and diseases are concerned this is true in very full measure. The future survival of mankind is largely bound up with finding out more and more about how they work, since it is only when we understand this reasonably fully that we can hope to control them with full efficiency and thus give a measure of accuracy to crop production to meet increasing future needs. H.T.

WORLD CROPS

OUR NEXT ISSUE will contain a number of articles and features on spraying and dusting machinery and equipment, including **Drift Spraying** by S. J. Zimmer, whose article on low volume sprayers appeared in WORLD CROPS a year ago, and **The Correct Use of the Low Volume Mist Blower** by J. M. Beskine. **The Murphy Chemical Company** will be the subject of the tenth article in our series, Industry's Contribution to Agricultural Research.

Modern Farm Dairy Equipment

By Ronald T. Needham. Pp. xi + 91, illustrated. Leonard Hill, London, 1952. 15s.

In this informative book the complete range of equipment required for processing milk after it leaves the churn until it is bottled is described in considerable detail by the author, who is a well-known contributor to our contemporary, *The Dairyman*. Mr. Needham states that it has been his aim in writing this book to assist prospective buyers in the selection of dairy equipment suitable for their particular requirements, especially as regards the size or capacity of the plant based on the daily milk production. He emphasises the importance of making allowances, when new equipment is being installed, for possible future expansion and in this respect it is well to give considerable forethought to the layout of the premises in which the dairy is to be installed.

The various methods of cooling milk (vertical flow, refrigeration, brine, churn immersion, etc.) are described in some detail; cleaning and sterilising equipment, pasteurisers and bottle-filling and capping machines are also described. One chapter deals wholly with layout plans for dairies, ranging from that of a producer-wholesaler or producer-retailer with under 20 cows to the larger type of premises designed for 75 to 100 cows.

The book is well illustrated with diagrams and photographs, and will be a boon to all dairy owners and managers.

The Land System in Palestine

By A. Granott. Pp. 359. Eyre and Spottiswoode, 1952. 21s.

This book, as the author himself says in his preface, 'is an attempt to describe as comprehensively as possible the agrarian regime and the land conditions in Palestine, with due attention to the Middle East in general, and especially the countries adjoining Palestine, and which resemble it in their historical, social and economic development.' It presents an historical review of conditions prevailing in Palestine, which all those who will be called upon to frame the new Land Laws of Israel will have to take into consideration, if it is desired to establish there a new, improved and progressive land system. It is the first book to include a review of the land systems in the Arab as well as the Jewish sectors of Palestine and should be read by everybody who desires to make a serious study of conditions prevailing there and in the neighbouring countries: Syria, Lebanon, Egypt and Transjordan.

After an historical sketch of the development of the agrarian regime under

the Moslems, it deals with various subjects such as the causes of the formation of large estates; development and forms of large estates; development and forms of small and medium land ownership; the special problems of Arab village life; the various categories of Crown Lands (under the Mandatory Government); the origin and regulations applying to Waqf land; the landed property of the Christian Churches in Palestine; the system of common land ownership, tenancy and leasehold conditions; and many other problems of the land system in the Middle East.

American Agriculture

Its Background and Its Lessons, by A. N. Duckham, C.B.E., M.A. Pp. 78. Illustrated. H.M.S.O., London. 2s. 6d.

Of recent years the query has frequently been propounded, 'can England learn anything from American farming methods?' The answer is sometimes dubious but of one thing there is no doubt, and that is that a great deal of instructive information can be derived from a comparative study of the farming methods of the two countries, although conditions may be such that the sum total that can be copied from one to another is small.

Mr. Duckham, who is now a member of the British Ministry of Agriculture, was for four years Agricultural Attache to the British Embassy in Washington and during that period spent much time studying the agricultural set-up in each of the 48 states of the Union, travelling upwards of 100,000 miles in the process. The fruits of his observations have now been set down in this booklet with the object of supplying technical and commercial information for those wishing to learn something of the social and geographical background to agriculture in the U.S.A.

Let us say at once that he has accomplished his self-imposed task with admirable efficiency, and within the compass of the 78 pages has compressed a mass of detailed comparative data which can prove invaluable to the seeker after information.

The report falls into four parts. Part 1 outlines the geographic and social background, Part 2 discusses the rural organisation and agricultural services. Part 3 deals with the research and production techniques, while Part 4 concerns farm organisation and labour economy, a field which, in the author's view, holds more lessons for British agriculturists than any other aspect.

He concludes that differences in soil and climate as well as in the rural set-up would make it dangerous to transplant U.S. practices to Britain and vice versa but, nevertheless, it is well worth while for British farmers to keep an eye on American research, farm practices and administrative devices. By U.K. standards U.S. husbandry is often poor, while by U.S. standards British farm organisation and labour economy could be greatly improved. The British farmer thinks as a practical biologist and is content to be judged by his skill in husbandry; the American farmer thinks as a practical engineer and is judged by his material wealth. If both British and American farmers could learn to adopt something of the other's point of view both would benefit.

The book can be cordially commended for study to farmers, experiment station workers and business men as a thoughtful and unbiased appreciation of a subject which deserves close attention. H.T.

Dead locusts lie strewn on the ground in Pakistan after successful spraying operations carried out by Piper Super Cub aircraft. Liquid Aldrin was the chemical used

Green Crop Conservation

The Economics of Green Crop Conservation, 1949 and 1950. Pp. 64, illustrated. Report No. 38 of the Farm Economics Branch, University of Cambridge School of Agriculture, 1952. 6s.

This publication is the latest report to emanate from the Farm Economics Branch of Cambridge University, the work of which is well known throughout the farming community of the eastern counties of England. Much of the editing of this report, incidentally, was carried out by the late Dr. A. W. Menzies Kitchen, who was Head of the Farm Economics Branch for 12 years until his untimely death last December.

In this report the economics of grass, clover and lucerne conservation in the Eastern Counties during 1949 and 1950 are considered on a comparative basis. A number of farms which practised haymaking, ensilage and grass drying, were investigated in both years to discover relative costs of production and the quality of feedingstuffs produced. The general conclusions were, briefly, that the quality of the grass conserved by any of the three methods depends upon the stage of growth at cutting (cutting in the early stages is essential); ensiling and haying are preferable to artificial drying where possible because of the high cost of the latter method, often without compensating differences in quality; lucerne was the cheapest source of protein in this enquiry; and home-grown conserved green crops produced with quality as the goal, are competitive with imported feeding stuffs.

It might be said that these conclusions are well known already, but the report gives far more than that, inasmuch as Mr. R. A. Mackness, who conducted the investigation, made a thorough study of the methods of grass conservation practised on the 160 farms that comprised his sample. He compares the quality of the conserved herbage with other feedingstuffs; from the figures quoted it is evident that hay and silage are comparatively cheap protein feeds. So far as dried grass is concerned the report states '. . . . the grass driers of this sample were not being

To Authors and Readers

The Editor and publishers of WORLD CROPS will be glad to consider manuscripts of books submitted for publication. We already publish a number of books on technical subjects, all of which find a world sale, and most call for regular reprints and new editions.

Books of a non-fictional type in any language by any publisher can be supplied by the Book Department of WORLD CROPS.

used for the purpose envisaged by the research workers who originally extolled the virtues of dried green crops. It is open to investigation whether they could be used economically to produce the high quality concentrate required, bearing in mind the need for cutting at intervals of not more than four weeks throughout the growing season. Undoubtedly the reason for the relatively poor quality of the dried herbage sample was the infrequency of cutting.' The report goes on to suggest that grass drying and ensiling are complementary processes; green crops which, if left to be cut for drying, might produce a low quality product, should be cut at an earlier stage of growth for ensiling.

There seems little doubt that, with rising world prices, home-grown conserved feedingstuffs are becoming more attractive to the British farmer, and a quality product is undoubtedly obtainable *if* the herbage is cut in the early stages of growth. To all those contemplating or practising green crop conservation this 64-page report will be a valuable source of information and reference.

EAAFRO

The East African Agriculture and Forestry Research Organisation, Annual Report for 1951. Pp. 88. East Africa High Commission, 1952.

The annual report of the East African Agriculture and Forestry Research Organisation for 1951 is a record of very substantial progress towards the full realisation of the scheme, originally propounded in 1946 for the unification and co-ordination of research in agriculture and forestry in East Africa. During the year the new headquarters at Mugega were virtually completed and the move from the old East African Agricultural Institute at Amani embarked upon and brought within sight of conclusion. Actually the move was successfully finished early in 1952. The new buildings and experiment station at Mugaga were opened by the Rt. Hon. J. Griffiths, P.C., M.P., then Secretary of State for the Colonies, on May 26, 1951, in the presence of Sir Philip Mitchell, G.C.M.G., Governor of Kenya and chairman of the East Africa High Commission, and a large and distinguished gathering.

The station comprises the estate of Mugega, about 14 miles north of Nairobi at an elevation of between 6,500 and 6,900 feet above sea level. Buildings include an administrative block and library, and three laboratory blocks of single storey design each containing six laboratories.

The capital cost of the scheme contributed under a C.D. and W. scheme by the British Government was £296,000. Under another C.D. and W. scheme the British Government also contribute half the recurrent expenses, the remainder being borne by the East African Governments.

Meantime, the various research projects already started have been maintained and others inaugurated so that it can be said that the project is practically now in full operation.

It is not possible to do more than mention a few of the activities. The underlying idea that new lines of work will be undertaken by *ad hoc* working parties as the need arises and harmonised to the existing conditions and requirements in various parts of East Africa is one which is essentially sound. Coupled with this, the correlation and co-ordination of the organisation work with that of other agricultural research institutions in East Africa, such as the research station of the Empire Cotton Growing Corporation at Namulonge in Uganda and the tea research station at Kericho as well, as with the work of the East African Veterinary Research Organisation.

The scheme is indeed one which has been drawn on sufficiently broad lines and which is already giving indications that from its operation East Africa will draw considerable benefits.

Actually under EAAFRO itself some 16 different lines of research projects are now in operation.

Among the most outstanding results are those achieved under the fertiliser research scheme, which will in future be conducted under the auspices of the research branches of the various East African Departments of Agriculture. The results of four years' work on the present scheme are being studied and important conclusions are expected to emerge.

Another direction in which definite results are emerging is the Clove Research Scheme in Zanzibar, inaugurated to elucidate the mysterious 'sudden death' disease. The scheme has also thrown a flood of light on the allied disease of clove trees known as 'die back,' as well as on the obscure disease of coconuts in Zanzibar known as gumming.

To the Director of the Organisation, Sir Bernard Keen, and those associated with him, great credit is due for having successfully brought the Organisation to the point of full fruition despite numerous difficulties and setbacks. The award to him of knighthood in the last birthday honours is an indication that his services have received the recognition to which they are entitled. H.T.

East Malling Report

East Malling Research Station, Kent, Annual Report, 1951. Pp. 208. Illustrated. 1952, 12s. 6d.

The East Malling Research Station's Annual Report for its 39th year covers the period from October 1, 1950, to September 30, 1951.

The Report is opened by a well-deserved tribute to the secretary, Mr. C. T. Royle, M.C., M.B.E.; the latter honour was announced in Her Majesty's first Birthday Honours List.

The general form of the Report remains unchanged. Part I reviews the work of the experimental farm during the season, a very late one, the cropping and marketing of the fruit crop and the spray treatments applied. Apple quality and size were good as in most seasons. Cherries, though few, were of excellent quality. Plums and soft fruits cropped well, apparently unaffected by the cold spring. Details are also given of the Station's range of glass-houses.

Part II gives a review of the research of each section. It well repays careful reading, for it gives details of work in progress but as yet not sufficiently complete for fuller report. It includes a full list of publications during the year.

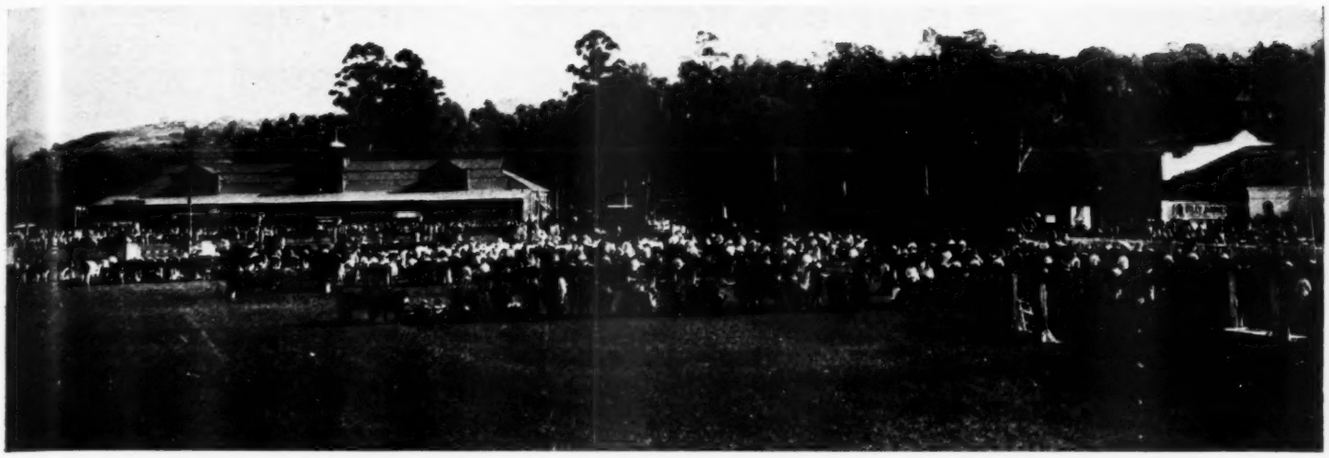
The research papers and reports to be found in Part III have again increased in number, now totalling 36. A few of these may chiefly interest scientists working on cognate subjects, but the majority will also provide interesting reading for fruit growers as a whole. This part of the Annual Report begins with the fourth Amos Memorial Lecture, by Mr. T. Neame, entitled 'Developments in Fruit Growing at Home and Abroad.' It includes papers on raspberry varieties, anatomical studies of apple trees, an investigation of the effect of the time of pollination and of the influence of the pollen parent on apple fruits, statistical methods employed in field trials, the control of fruit drop, advances in analytical technique, a series of important papers on virus diseases and their vectors, the summer fruit tortricid, methods employed for testing fungicides, spray damage, and new selections of Golding hops, and Dr. Massee's annual review of fruit pests and other insects of interest to the grower.

Part IV contains articles on use of continuous water sprinkling as a means of protection from spring and autumn frosts, the pruning of maiden apple trees and on the new organic fungicides.

The Report is very fully illustrated by line drawings and nearly 50 photographic plates, and has a valuable four-page index.

It may be obtained from the secretary, East Malling Research Station, nr. Maidstone, Kent.

SHOWS AND DEMONSTRATIONS



View of the grand ring at the Natal Show. Photograph taken while cattle judging was in progress

Natal Royal Agricultural Society's Annual Show

THE annual show of the Royal Agricultural Society of Natal is a feature of the agricultural and social life of the province, which attracts exhibits as well as visitors from all parts of the Union of South Africa. The 91st 'Royal Show' was held in Maritzburg, during the five days June 24 to 28. The Society possesses extensive permanent grounds with well constructed buildings and all the accommodation necessary to a well-organised show. Interest this year was greater than ever, and attendance during the five days exceeded 50,000 persons. The official opening took place on Wednesday, June 25, when Admiral Sir Herbert Packer, K.C.E., C.B.E., carried out the ceremony of declaring the show open, and His Excellency the Governor General was present with a distinguished gathering. The perfect weather and the immense parade of horses and cattle in the ring made the occasion an outstanding spectacle. Admiral Packer spoke of the enormous resources of the sea for supplies of food for the rapidly increasing populations of the world.

Among the many features were the daily displays and competitions in the grand enclosure, which followed the pattern familiar to agricultural showgoers in England. Indeed, the whole arrangements were closely similar to those of shows in England.

There were many thousands of exhibits and apart from the livestock and agricultural produce, the great variety of manufactured foodstuffs and miscellaneous goods indicated the extensive range of industrial activity in Natal. Agricultural machinery was in a special section and gave evidence of the high degree of mechanisation of agriculture, and of interest in this feature of farm life. Fertiliser manufacture was represented by firms in their own display buildings.

Sugar industry's display

The industrial displays included exhibits of the cane-sugar, and wattle industries. The former included the sugar industry exhibit of the Van Riebeeck Festival held in Capetown earlier in the year. The discovery and development of Natal, and the establishment and progress of cane-sugar production were depicted in large mechanised dioramas and coloured photographs. Two large action flow diagrams enabled the visitor to follow the extraction of raw sugar from the cane to refining. Individual stages being shown by models of the equipment used in a sugar factory, the flow of juice being made visible by liquids bubbling through glass tubes. The working model of Morewood's Mill which extracted the first sugar obtained commercially from cane in Natal formed a remarkable contrast to the extensive buildings of the central sugar refinery in another diorama of the series. Dominating the exhibit was a schematic representation of the machinery of a sugar mill moving at the characteristic, slow rate. The uses of sugar in industry illustrated by a variety of products formed the centrepieces of the display, while price labels demonstrated that consumers in South Africa pay less for a pound of sugar than do users in any other country. A special section devoted to research contained a scale model of the South African Sugar Association's Research Station at Mount Edgecombe.

Wattle industry

Less spectacular, but also well planned and executed, was the Wattle Industry Exhibit, housed in a pavilion constructed entirely from wattle timber. The object was to attract attention to the major product of the industry—Black Wattle tanning extract.

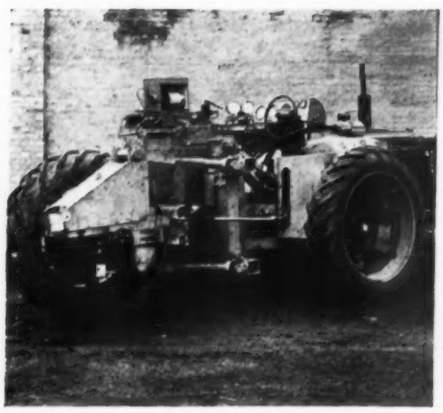
Black Wattle is grown on plantations in South Africa totalling some half a million acres, principally in Natal and the Transvaal. Ten years after planting, the trees are felled and the bark stripped from the stems. This may be sent directly to a factory for extraction of the tanning or it may be air-dried, when it can be kept indefinitely. The product is marketed as extract, and as bark, which may be either chopped or ground. The method of extraction is by treatment with water in open vats or autoclaves; the solution is concentrated under vacuum, as in sugar factories. The final concentrate is discharged from the vacuum pan into bags where it sets to a solid dark brown mass displaying a conchoidal fracture on breaking. The whole process is conducted under strict chemical control.

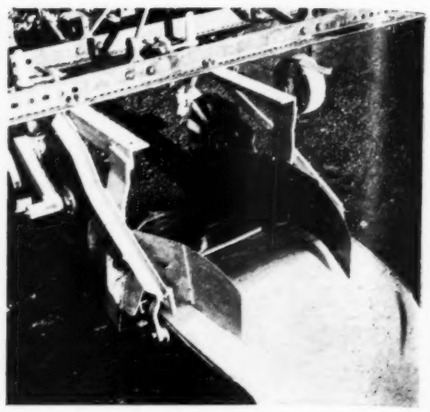
At the show, methods of extraction were demonstrated by a working model. The displays showed methods of packing the products for export and the countries in which South African wattle extract is used. No less than 94% of the total production is exported.

The 1952 Show imposed a heavy task on the South African Railway, which conveyed 700 carloads of exhibits to and from the sidings at the showgrounds.

A. C. BARNES

Open Day at the National Institute of Agricultural Engineering





(*Left*) **N.I.A.E. single-wheel tester** (*Centre*) **Irrigation investigations: sprayline distribution studies** (*Right*) **Ridge collecting apparatus for use during testing of a potato harvester**

THE headquarters of the N.I.A.E. at Wrest Park in Bedfordshire were open to the public on July 24, when the many aspects of the Institute's work were displayed. The last Open Day was held two years ago (see WORLD CROPS, **2**, 7, pp. 296-298) when a wide range of exhibits was staged to illustrate the main functions of the Institute: research, development and testing. This year it was felt that visitors are more conversant with the aims of the Institute and it was decided to confine the displays to details representative of the current work of the departments and to stage them in and around the buildings and fields where they are normally carried out. There were some 30 aspects of the work being carried on for visitors to inspect, ranging from basic research on tractor wheel performance to testing of commercially manufactured farm machinery and exhibits of equipment developed at the Institute.

Research and developments

Probably more of the Institute's work comes under the above heading than any other. To take the more basic research first, a considerable amount of work has been done on the subject of wheel performance—since 1940, in fact—and an apparatus for determining the amount of slip and rolling resistance of different tractor wheels under varying loads and soil conditions has been developed. Driven by an electrical transmission, a single wheel mounted behind the two rear wheels of an ordinary row-crop tractor pushes the whole tractor along; the operator can read his various instruments while the tractor is on the move by means of enlarged instrument dials mounted adjacent to the steering position. Development on this equipment is still continuing and it is envisaged that the tester will be available for routine work on tyres.

Toolbar-mounted fertiliser placement seeder unit

Since 1948 the Soil Department has been occupied with plough research in order to find out precise information on the forces which act on plough bodies in the soil. A standard three-furrow trailer plough has been modified so that the middle beam, its body and coulter are held in place entirely by six dynamometers. The readings from the dynamometers are transmitted through a 50-ft. cable to recording apparatus in a lorry chassis, which is, in effect, a mobile laboratory. At present, comparisons are being made between the performances of three standard plough bodies, the Ransomes YL as the general purpose, the Ransomes IRDCPT as the semi-digger and the Ransomes DM as the digger. First results have shown a similarity between the forces acting on the three types of body; a great deal of further works remains to be done.

The use of fans for bringing down the warm inversion layer as a method of frost prevention has been the subject of experimental work at the N.I.A.E. for a number of years. By using a helicopter mounted 30 ft. above the ground it is hoped to test a theory that a 60-ft. fan consuming 20 h.p. will protect 10 acres.

Horticultural engineering

In regard to spraying, work on the quantity and fineness of particles of chemical deposited by the low volume sprayer and its effectiveness of control of the pest is being carried out by the Horticultural Engineering Department. In the laboratory apparatus is installed for producing uniformly sized droplets, measuring total spray quantity by relating it to colour intensity of a dye added to the spray, measuring drop size and photographing the formation of drops as they leave various designs of nozzle.

Experiments on adapting the spinning disc system by cupping or vaning the disc, clamping several together or using a crinkled shape, have been used to control and enlarge the size of the droplets for machines using this method of low volume spraying.

Other work in the Horticultural Engineering Department includes measurement of the amount of water used by a tomato crop each day and relating this to the daily amount of solar energy received from sun; a comprehensive programme on the heating and ventilating of glasshouses; steam sterilising of the soil; tractor steering investigations to determine the best type

and gear ratio of the steering mechanism, and the position of the driver's seat in relation to the tools carried.

Irrigation studies

Extensive studies have been made of sprayline water distribution in still air and under natural conditions. Also a study of droplet size in relation to soil compaction and crust formation has been carried out and it would appear that small droplets cause more crust formation than large ones.

An interesting set of irrigation maps of the British Isles has been prepared, based on transpiration formulae and applied to irrigation practice. From these charts the grower can see just how much irrigation his crops require over and above normal rain in order to obtain maximum benefit and growth from the optimum amount of water.

Testing

This aspect of the Institution's activities is primarily a service to manufacturers. Wherever possible the method of test is standardised and during the Open Day the scope of these tests as carried out on tractors, potato harvesters, and grass driers was illustrated. Most of the equipment for these tests has been designed and made by the N.I.A.E.; for instance, a ridge collecting apparatus for use when a sample potato ridge is required has been designed and consists of a roll of strong rubberised canvas about 24 in. wide which trails out behind a standard potato-digging attachment so that, in effect, the canvas follows the digger beneath the ridge and collects the ridge in its entirety—soil, stones, potatoes and haulms.

Research and development on grain handling and storage carried out at Wrest Park has made a substantial contribution in its progress in relation to combine harvesting. As an example, the platform sack drier was developed. At present work is being carried out on an experimental grain silo with porous brick floor through which heated air can be introduced to rise up through the grain to the top of the silo.

An experimental grain cleaner has also been developed, having an output of 50 cwt. per hour. For power this relies on one ½ and two ⅓ h.p. motors to drive the elevators together with a 2 h.p. cleaner motor. It has been claimed that the whole electricity bill for one season for cleaner and elevator was only 10s.

Overseas readers will be interested to learn that work is being carried out on experimental drying of sorghum and coffee.

Annual Report

For those who are not in a position to visit Wrest Park and see for themselves the multifarious activities, and indeed for those who have, the Report* of the National Institute of Agricultural Engineering and Scottish Machinery Testing Station, for the two-year period October 1, 1949, to September 30, 1951, has been published recently. This includes a general introduction to the work of the N.I.A.E. by the Director, Mr. W. H. Cashmore, and nine departmental reports describing the work that has been carried out during the period under review.

As the director says in his introduction: 'The period covered by this Report is the first two years under the A.R.C. (Agricultural Research Council), and as this was the period during which the N.I.A.E. was being built up it was considered more satisfactory not to divide it, but in future a Report will be issued annually.'

The report can be recommended to all who are interested in the development and progress of agricultural engineering both at home and abroad. R.G.P.

*The British Society for Research in Agricultural Engineering, 1952. Pp. 119. 8s. 6d. From the N.I.A.E. post free.

Towards Educating the Peasant Farmer

THE importance of teaching the peasant cultivator the principles of machinery maintenance and servicing must be evident to all agriculturists who have had to do with the development of territories where available labour consists in the main of native cultivators who are for the most part illiterate. Any machinery manufacturer wishing to increase sales in such areas must consider these first things first and build up an education organisation so that in the course of time—and two or three years may go by without any visible sign of results—there is at least a nucleus of local nationals who are sufficiently conversant with machinery maintenance to be competent to pass on their knowledge to others, so that gradually and very slowly the farmers become 'machinery conscious.' It is only in this way that there can be any hope for farm mechanisation in such territories as, for instance, the British, French and Belgian colonies in Africa. Without this basis on which to operate the ignorance of the machinery operator through lack of instruction will result in the abuse of the machinery of which he has charge, and a general antipathy towards mechanised agriculture of any sort, which would make any further attempts at introducing equipment considerably more difficult.

Apropos of this, an example of how one machinery manufacturer is getting it across to the native cultivator was demonstrated by the Massey-Harris Company, who have recently held courses of instruction on row-crop and rice equipment for colonial agricultural officers and others who come in contact with the users of

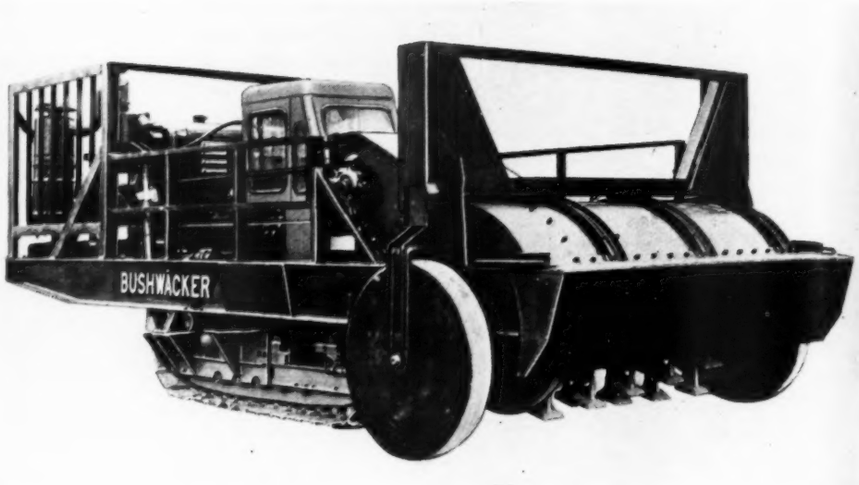
Tillage engineer W. H. Ward (wearing hat) discusses rowcrop cultivation with some of the students, including (on his immediate right) R. N. Scott, farm manager for O.F.C. in Tanganyika, and (leaning against tractor) Fadl Abdel Magid Mohammed, an agricultural student from the Sudan

FARM MACHINERY

farm equipment in the colonial territories.

The object of these courses, which lasted up to two weeks, was to provide those who attended with practical instruction in the use and servicing of modern farm machinery. It was practical in nature and limited to basic principles of field adjustment and working maintenance. The courses were held in Sussex and a range of Massey-Harris tractors and equipment was available for demonstration purposes. Over a hundred attended, coming from most parts of Africa, including British, French and Belgian territories; also Australia, Belgium, British Guiana, Fiji, France, Germany, Italy, Portugal, South Africa and Turkey. The syllabus included lectures and demonstrations on the diesel engine, transmission and hydraulics, tractor service, tyre adjustments and repairs, lubrication, electrical equipment, tillage, cultivation, harvesting, grain storage, anti-soil erosion, spraying equipment, planting tools and rice machines.

A further instance of the work this company is doing towards educating the peasant farmer is the production of a new maintenance log book for the 744 D diesel tractor, which gives the daily, monthly and yearly service the unskilled tractor operator should carry out. For the benefit of those who cannot read a small symbolic figure is used in the drawings pointing out the various jobs that must be done; after initial instruction it is hoped that the operator will be able to carry out the correct service with the aid of this book.



The Bushwacker, a ' mowing machine for trees,' mounted on an International Model TD-9 diesel crawler tractor

New Land Clearing Equipment

The Bushwacker, ' a mowing machine for trees,' that clears land at tractor speeds through dense undergrowth and wooded areas, is now available as part of the International Industrial Power and Allied Equipment line marketed throughout the world by the International Harvester Export Company.

The machine is a substantial piece of equipment, weighing 14 tons, mounted on an International model TD-9 diesel crawler tractor and powered by a 168 h.p. diesel engine. It is 11 ft. wide, 21½ ft. long overall and clears a swath 6 ft. wide at speeds from one and a half to five miles per hour.

It is claimed that trees up to eight in. in diameter and all undergrowth are reduced to small fragments and deposited upon the ground. The topsoil is not disturbed. Regrowth is retarded, due to the fragmentation of trunk fibres at the root junctures. Practically all types of native growths have been cleared by the Bushwacker, including oak, maple, hickory, pine, willow, palmetto, honeysuckle, bullbriars and other noxious growths.

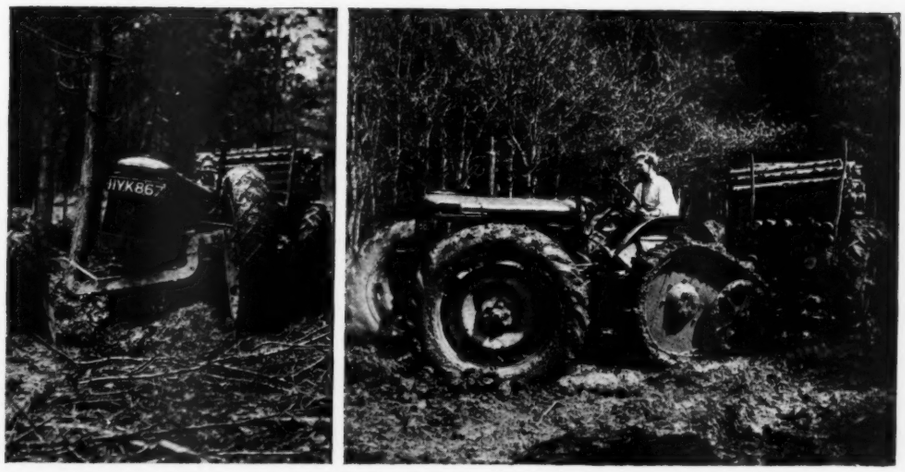
The operating principle of the Bushwacker is relatively simple. 19½-lb. chrome manganese steel ' flails ' are attached by chains to a revolving steel drum, mounted on a shaft at the front of the machine and partially enclosed within a heavy steel housing. The drum is powered by the 168 h.p. diesel engine and revolves at 1,050 r.p.m. The 20 flails travelling at about 11,500 f.p.m. strike the growth with such force that the fibres are shredded. The trees or bushes are reduced to small fragments through further contact with the flails as the growth is carried back against the drum housing.

A Ferguson tractor and mounted plough at an introductory demonstration of the Ferguson range in Iraq, where they are being handled by Rafidain Developments Ltd.

The Commando Major

A modified Fordson Major with standard v.o. engine, developed in conjunction with Roadless Traction Ltd. for timber extraction, was demonstrated recently in a Hampshire forest. This experimental tractor was fitted with DG4 roadless half-track equipment and the standard front

The Oliver No. 8 wire tie baler



Modified Fordson Major at work hauling timber. Note the wide front axle and 11 x 36 wheels. This is still an experimental machine

Wire-holding case, opened up to show the two spools of baling wire

wheels had been replaced with 11 by 36 wheels and tyres. These were fitted to the standard stub axles by special adaptors. The front axle was the only major change, this being cranked and very much wider. It has been made of cast steel to withstand the loads imposed upon it. Other modifications include alterations to the steering linkage and a larger (18-in.) diameter steering wheel. The aim of this conversion is to reduce rolling resistance on undulating territory and enable it to negotiate obstacles such as deep drainage ditches and rides which are impassable to other types of wheeled or tracklayer tractors. In addition to timber extraction it must also be suitable for ploughing, as some 60,000 acres of new and cleared forest land are ploughed annually.

The tractor can haul loads of up to 5 tons gross weight under these conditions. A special four-wheeled trailer used, which is also fitted with standard 11 by 36 wheels and tyres, is also experimental equipment.

The overall width of the machine is 7 ft. 6 in.—which is a drawback. The extra width means that it cannot be loaded on to a standard truck for transport. A reduction in width would also improve manoeuvrability in narrow rides, but it is difficult to see how this could be accomplished. Equipment of this type has been used for negotiating swampland areas in Africa during operations for locust control and undoubtedly other uses will be found for it, particularly on jobs where a high drawbar pull is required on soft land conditions.

Tractor Price Reductions

David Brown Tractors, Ltd., announce that they are passing on to customers the benefit of recent reductions in tyre prices. The retail prices of David Brown tractors in the home market have, therefore, been reduced as follows, from July 8 :—

All tractors fitted with :		
11.28 rear, 4.50 x 19 front tyres	£5	reduction
11.28 rear, 6.00 x 19 / 9.00 x 28 front tyres	£5 10s.	,,
11.25 x 28 rear, 6.00 x 19 / 13.00 front tyres	£7	,,

These reductions follow closely upon the recent introduction of a more powerful Cropmaster Diesel tractor. The new prices are :—

	£	s.	d.
Cropmaster 6	507	10	0
Cropmaster 6S	529	10	0
Cropmaster Vineyard 6 (Narrow Track)	508	0	0
Cropmaster Vineyard 6S (Narrow Track)	530	0	0
Cropmaster Vineyard Diesel	675	0	0
Cropmaster Diesel	674	10	0
Super Cropmaster	588	0	0

Trade Publications Received

'Prevent Down Time' is the title of a new booklet of the Caterpillar Tractor Co., Peoria, Illinois, describing the equipment service of the Company and its usefulness in preventing 'down time,' which is the period when, due to mechanical failure, equipment is not working and valuable time is lost. Illustrations show how the Caterpillar dealer offers facilities for the maintenance of equipment.

'Pneumatic Grain Conveyors and Storage Equipment.' This booklet has been compiled as a guide to the King Cyclonic pneumatic grain conveyor and storage plants, manufactured by Messrs. Geo. W. King, Ltd. It includes details of mobile grain conveyors, a mobile suction and blowing unit, drying and conditioning equipment, conveying and storage equipment, and pre-cast concrete silos.

'The Dryvent Method of Grain Drying and Ventilation.' A paper issued by Messrs. Mitchell, Colman and Co., dealing with aspects of deep and shallow drying and storage. The Dryvent plant consists of a layout of perforated trunking arranged on a floor so that air can be uniformly distributed through the mass of grain. In the 18 pages of this booklet the theory and practice of the Dryvent system are fully described, together with the use of other ancillary equipment manufactured by this firm.

A new folder has been announced by Messrs. **Wolseley Sheep Shearing Machine Co. Ltd.,** manufacturers of the Wolseley electric fencing system. The folder contains particulars of all the equipment needed for fencing a 200, 300, 400 and 500 yd. front for strip grazing or kale folding.

WORLD CROP REPORTS

WORLD

Sugar—a new high record. World production of centrifugal* cane and beet sugar reached an estimated 38.2 million short tons, raw value, in 1951-52. This is approximately 4.1% more than the 36.7 million short tons of 1950-51, 37.9% more than the average 27.7 million tons of 1945-49, and 32.2% more than the average 28.9 million tons for 1935-39.

Indicated world production of non-centrifugal sugar has increased to 6.2 million short tons, tel quel, in 1951-52 from the 6.1 million tons of 1950-51.

World centrifugal cane sugar production is estimated now to total 24.1 million tons in 1951-52, an increase of 10.6% over the 21.8 million tons of last season. While sizable decreases in cane sugar production are noted in Australia, the Union of South Africa, and the United States, expanded acreage and favourable weather in other cane-growing areas have more than offset this decreased production. Cuba alone has increased production by 1.6 million tons and production in Asia is 660 thousand tons greater than that of last year.

Beet sugar production this season is estimated now at 14.1 million tons or 5.4% smaller than last year's crop of 14.9 million tons. Production for 1951-52 in Europe was 360,000 tons lower than the record crop of 1950-51, primarily because of unfavourable weather and disease damage to the crop. Sizable decreases in production are noted also for the United States and the Soviet Union, while production has increased for the Asiatic beet sugar producers, Turkey and Iran.

In the North and Central American areas, centrifugal cane and beet sugar production is estimated to total 15 million tons, compared with 13.8 million tons in 1950-51. The staggering record production of 7.9 million tons estimated for Cuba after a much lower November estimate, may be attributed to higher yields than previously indicated and increased acreage.

European production (excluding the U.S.S.R.) of centrifugal sugar totalled 9.7 million tons for 1951-52, a decrease from the 10.1 million tons of 1950-51. Adverse weather, disease and lower sugar content of beets offset increased acreage in most countries. However, increased production is noted in Austria, Western Germany, Italy, Roumania, Spain and Yugoslavia. The Soviet Union, which experienced a drought this year, produced an estimated 2.3 million tons in 1951-52 compared with 2.4 million tons in 1950-51.

South American sugar producers manufactured 3.8 million tons in 1951-52. Only Ecuador failed to maintain or increase production in this area. Brazil and Argentina accounted for the larger part of the increase of South American production. The drop in African sugar production from 1.8 million tons in 1950-51 to 1.7 million tons in 1951-52 partially reflects the large decrease of production in the Union of South Africa. All other areas of Africa except Angola increased production this season.

Adverse growing conditions in Australia and Fiji were responsible for the decreased production in Oceania from 1.2 to 1 million tons from 1950-51 to 1951-52.

(From one of the reports on world agricultural production approved by the Office of Foreign Agricultural Relations Committee on Foreign Crop and Livestock Statistics, U.S. Dept. of Agriculture.)

* Centrifugal sugar, as distinguished from non-centrifugal, includes cane and beet sugar produced by the centrifugal process, which is the principal kind moving in international trade.

U.S.A.

Official crop report. The Crop Reporting Board of the United States Department of Agriculture makes the following estimates from reports and data furnished by its crop correspondents :—

	Production (million bushels)				
	July 1, 1952	June 1, 1952	Final, 1951	Final, 1950	Average, 1940-49
All wheat	1,249.0	ungiven	987.5	1,019.4	1,071.3
Winter wheat	1,048.4	1,060.3	645.5	740.7	791.8
All spring wheat	200.6	265.9	342.0	278.7	279.5
Durum	21.0	ungiven	35.8	37.2	37.4
Other spring	179.6	,,	306.2	241.5	242.2
Maize	3,365.1	—	2,941.4	3,057.8	2,980.8
Oats	1,352.9	ungiven	1,316.4	1,410.5	1,311.7
Barley	207.5	,,	254.7	303.5	306.5
Rye	15.6	17.0	21.4	21.3	30.2
Linseed	28.3	—	33.8	40.2	37.2
Soy beans for beans	—	—	280.5	299.3	178.6

	Harvested Acreage (thousand acres)			
	July 1, 1952, acreage for harvest	Final, 1951	Final, 1950	Average, 1940-49
All wheat	70,400	61,424	61,610	62,624
Winter wheat	50,300	39,762	43,253	44,640
All spring wheat	20,100	21,662	18,357	17,984
Durum	—	2,518	2,829	2,591
Other spring	—	19,144	15,528	15,393
Maize	82,200	81,306	81,817	87,882
Oats	38,700	36,454	40,733	39,460
Barley	8,200	9,391	11,153	12,569
Rye	1,300	1,718	1,730	2,448
Linseed	—	3,904	4,090	3,919
Soy beans for beans	13,900	13,211	13,814	9,348

SOUTHERN RHODESIA

European-grown summer crops, 1950-51 season. The 1950-51 season was one of the worst seasons experienced by European farmers in Southern Rhodesia, reports the Central African Statistical Office in a recent bulletin.

The first rains of any account fell during the first two weeks of November, but good planting rains did not occur throughout the country until December and continued until the end of January.

Crops were planted later than in the previous season, but conditions were favourable and the growth, in general, was very good. Unfortunately, from February onwards, an almost total drought, lasting from four to six weeks, affected nearly every district adversely and, if fair rains had not fallen in March, crops would have been a total failure.

Noticeable features of the season were:

(*a*) The average yield per acre for maize was only 3.42 bags, the lowest since 1917-18, when 3.08 bags per acre were harvested.

(*b*) Record acreages were planted to both maize and Virginia tobacco, 343,521 acres and 169,558 acres respectively.

(*c*) The average yield for flue-cured tobacco (541 lb./acre) was the worst since 1943-44, and for fire-cured tobacco (420 lb./acre) the worst since 1938-39.

(*d*) The acreage under Turkish tobacco showed a further decrease: 326 acres, compared with 725 acres in 1949-50.

(*e*) All important crops showed decreased yields over the previous season.